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Agriculture

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Rumination

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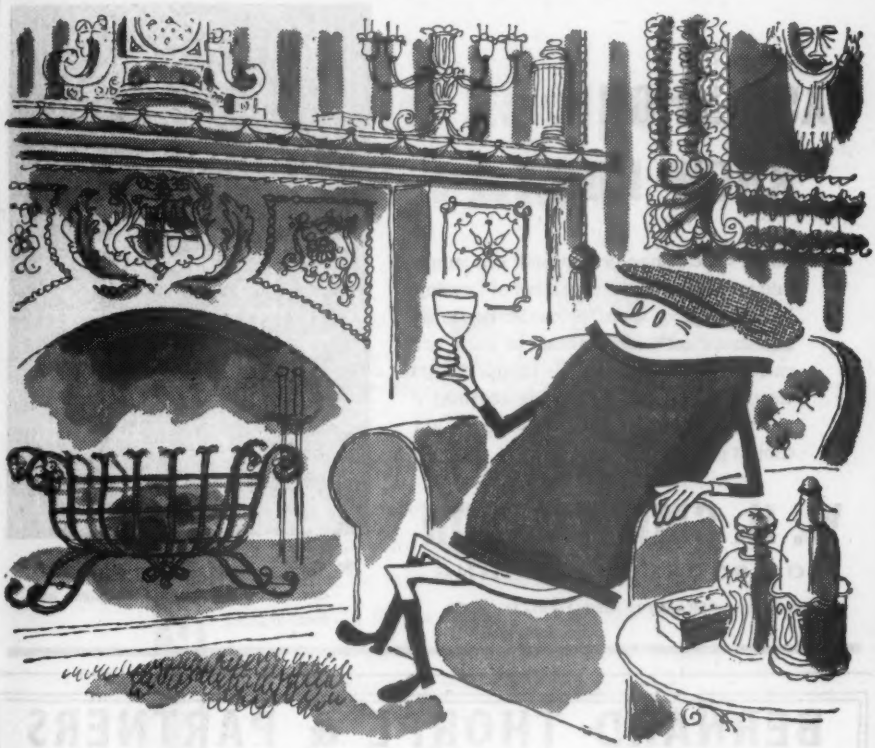

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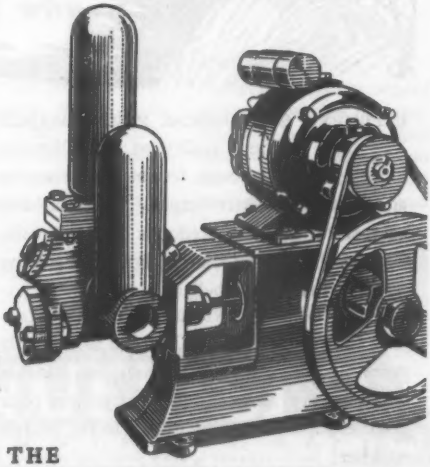

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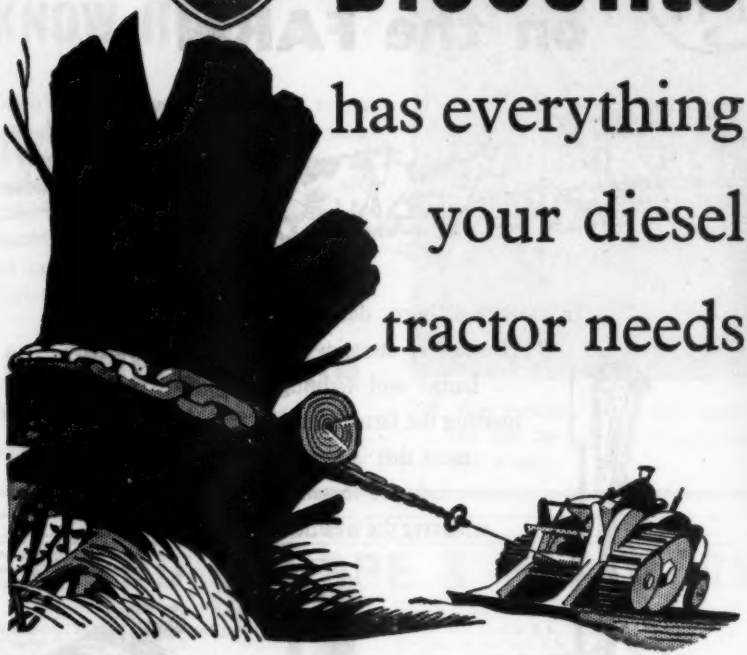

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AGRICULTURE

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FARM SCIENCE AT BRISTOL

W. B. MERCER, C.B.E., M.C., B.Sc.(AGRIC.), N.D.A.

This year's meeting of the British Association for the Advancement of Science was held in Bristol on August 31–September 7. Mr. Mercer, who was President of the Agriculture section, discusses some of the aspects of farm science which came under review there.

MEETINGS of the British Association are recognized as a sort of Pentecostal feast of the scientists, where researchers in many fields commune with one another and with the multitude. The researcher spends much of his time "voyaging in strange seas of thought alone"; at any given moment only a handful of people are interested in his immediate objective; yet every project has some bearing on other researches. It is not until the fruits of many inquiries are brought together that their full value, the bearing of one upon another, become evident. Usually, syntheses are confined to one branch of a science, or one particular science. Most of the British Association discussions are limited to sectional meetings. Occasionally, however, discoveries are of such magnitude or converging researches lead to such startling conclusions that half a dozen sciences are affected. It would seem that biochemists and other workers have now reached such a point in the study of certain constituents of cells and their nuclei. The highlight of the Bristol meeting was a symposium on deoxyribonucleic acid (or DNA for short) with chemists, mathematicians, geneticists and biologists all taking part.

It can hardly be claimed that the British Association attains the standard of that early Christian gathering at which "every man heard them speak in his own language", though it is their declared purpose to interpret science and to make discussions intelligible to the general public; to which end some restraint is exercised in the use of technical expressions. Unfortunately, more than simplicity of language is needed to convey mathematical concepts and the reader is referred to other journals and other expositors for details of the discussion on DNA. But however dim the comprehension, no one could enter the rarefied atmosphere of this symposium without a sense of awe; for apparently the acid represents, if not the unit of life, the key to the way in which the life process works. It becomes more and more probable that genes depend for their specificity on the molecule of this compound —a molecule which builds itself up in an extraordinarily complex manner. The structure of the molecule is known; its manner of reproduction. It gives us a vision of what a virus really is; it may explain cancer.

Long Ashton One got a fine sense of the fundamental unity underlying diverse researches and of the general application of specialized studies at Long Ashton, to which the Agriculture section paid a visit. Long Ashton was founded for the study of fruit-growing and cider-making; its departments provide for research into nutrition, influence of stocks, interaction of tree-types, manner of training, methods of controlling pests and diseases, the fundamental processes involved in cider-making; and projects range from abstruse problems such as the movements of hormones within plants to simple practical trials on methods of training fruit bushes—all designed primarily for the specific purpose of throwing light on the life-processes of the fruit tree. How far that design has succeeded may be gathered from our present-day knowledge of the manurial requirements of fruit trees, most of which derives from this Station. But the ultimate influence of the researches stretches far beyond the narrow field of fruit-growing. Minor elements are, or may be, of consequence in every branch of agriculture everywhere; the influence of grass on trees is important in fruit-growing, yet it is but one instance of the interaction of competing species, a problem of almost infinitely wide occurrence.

Fifty years ago it seemed that everything of any consequence about crop nutrition was known—apart from lime, the only elements of importance were N, P and K. We now know that this is altogether too simple a notion. Moreover the classic view that plants absorb their food material in solution from the soil is by no means all the tale; they can, and do, absorb nutriment through the leaves (though just how they do it is not yet clear). As to the mycorrhiza, they are on the roots and presumably they fulfil some function: but their place in the scheme of things does not seem very significant.

Grass Somerset, like other parts of the West Country, has long passed its ploughing peak and today on all the heavier farms stock are kept mainly on leys of various ages; some farms indeed, like that of Mr. E. M. Owens of Langford, are entirely in grass. Rainfall normally is high—35 inches or more—and the growing season long (though this year even Somerset shows signs of drought). Hay is still the main winter fodder on most farms and the pick-up baler is everywhere in evidence. Silage accounts for but a small fraction of the conserved crop; yet where it is exploited it is made to furnish almost the entire winter keep. Mr. Owens, for instance, makes some 700 tons for a herd of 150 cow-equivalents, or well over the "ton a leg" standard of the Midland farmers. Others in the same area make comparable amounts. Although theoretically leys can be managed to provide almost continuous crops for ensilage throughout the summer, most farmers as a matter of convenience in farm planting, as well as to meet the natural flush of growth, tend towards an all-out effort during May. What follows, if anything, is a mere collection and disposal of unconsidered trifles. There is a tendency, too, to concentrate on certain fields specially seeded down for the purpose rather than to take cuts from randomly scattered fields. Buckrakes play a large part in collecting the crop, as much as 20 tons of grass a day being handled by one tractor.

Seepage from May grass is considerable; if a good deal of rain falls while the silage is being made it may involve serious losses. Everyone seems to be agreed about the necessity of cover; where silage is made on a big scale the construction of a container within a Dutch barn is now favoured. We saw a number of these structures, with walls of breeze blocks up to 8 feet high; in one case a movable end-wall of timber, appropriately strutted, had been constructed to facilitate carting out. There seems to be little gain from

sealing the surface. Winter rations of silage run up to 100 lb. per head for dairy stock. On some farms nothing else is fed to cows giving up to two gallons per day; on one a rationing system in reverse is practised, the standard ration for the herd being based on 100 lb., but the quantity of silage being reduced as concentrates are added for the higher yielders. There are, however, some risks in feeding silage at very high rates; several farmers spoke of encountering acetonaemia and similar digestive troubles when using very large rations of high-grade grass silage.

Cheese It was cheering to see that the art of cheese-making on the farm still survives, though admittedly the industry is but a shadow of its former self. The making process has been partially mechanized; a power-driven paddle now replaces the wooden rake for agitation of the curd. A demand of surprising size has grown up for Caerphilly, and this "make" is now displacing the traditional Cheddar. Though the connoisseur may raise scornful eyebrows and the nutritionist look pointedly at the moisture content, taste knows no laws but has the final say. Fortunately for cheese-makers, the time needed for making Caerphilly is short—little more than half that for Cheddar—while yields run from 1¼ to nearly 1½ lb. per gallon of milk. Whey butter is nowadays a normal side-line, pigs getting only the separated whey; but since the quantity of fat in the whey may be a measure of the inefficiency with which the curd has been handled, the prudent visitor does not press too closely for information on the yield of butter per 100 gallons. Normally it runs about 2½ lb., and its value is close to that of fresh cream butter, from which indeed it is often indistinguishable.

Pigs As in other parts of the country, cross-breeding with the Landrace is largely practised. At two large establishments visited, pig fattening was being carried on in recently erected feeding houses of Danish type. Built of brick and breeze concrete to specifications very closely resembling the original type of thirty years ago, it was claimed that they yielded excellent results and that no unusual health troubles were encountered; improved insulation and ventilation had between them overcome the failings encountered by pioneers in this type of building.

One of Messrs. Aplin and Barretts' farms furnished an interesting system of pig breeding and rearing on arable land. Here a herd of 100 or more Large White and Wessex sows (crossed with Landrace), housed in movable huts, are folded throughout the year on a succession of crops and residues. At the time of our visit they were on ground from which Arran Pilot had been lifted: they were due to move on to the residues of maincrop potatoes, to sugar beet tops and then to fodder beet, where they would remain till they passed on to leys in March. In preparation for the sows, fodder beet is sown as part of the mangold crop, the seed being fed down an outside spout of a five-row drill, the crops thus containing alternating blocks of two rows of beet and eight of mangolds. At harvest time the mangolds are carted off for the dairy herd.

A Pilot Farm When farms are thrown open to inspection by visitors, they generally have their Sunday clothes on, or at least their second-best suits; no one could say that those which we visited failed to do honour to their occupiers; here capital invested in former years was bearing fruit. By way of a change, we also went to see a farm still in the making. It is that of Mr. H. Chamberlayne, who, in 1952, offered his holding as a guinea-pig for experiment. A dairy holding of 130 acres, it was then yielding a gross production of £27 per acre and a net profit of under £5 per acre. Under the guidance of the C.A.O. and the University Economics Liaison

Officer, a plan for development was drawn up and has since been put into practice. Broadly, the plan aimed at ploughing out to provide fluid cash to increase stock, the intention being to return as soon as practicable to a mainly ley holding carrying a larger dairy herd. To date the scheme has worked well. Fortunately 1953 was a good arable year, crops were big and it was possible to start almost at once enlarging the herd. Gross yields have now risen to nearly £40 per acre, and the output per acre of fodder crops has doubled. Net profits have more than doubled.

Range of Debate And thus was exemplified the range of the Association's interests; at the one extreme probing the physical basis of life, at the other studying the means of living on a small farm. J. F. Wolfenden, in his presidential address to the Education section, expressed the opinion that not more than 25 per cent of the population would ever be able to enter fully into the scientists' ways of thought. If the discussion recorded in the first paragraphs of this report can be taken as a fair test, the estimate seems generous. But even the 75 per cent can enter into the problem of making a little money go a long way, for that problem is not confined to small farms.

PLANNING FOR PROFIT

P. A. NAYLOR, DIP. AGRIC., N.D.A.

Eastern Province, National Agricultural Advisory Service

This practical example of the use made of partial budgeting on a Hertfordshire dairy farm to find the most profitable system clearly illustrates the potential value of the method to all farmers contemplating changes in farm management.

IN a recently published booklet, *The Farm as a Business* (1), emphasis is placed on the need for increasing economic efficiency and the combining of technical progress with wise management of resources. The booklet deals with business analysis, the measuring of economic efficiency, and budgeting of changes in farm organization. Several theoretical examples of budgets are given. F. G. Sturrock and D. B. Wallace (2) have similarly described the process of budgeting, still drawing mainly on theoretical examples. The process is also described in a report (3) of the Farm Economics Branch of Cambridge University, and in a recent article in this JOURNAL V. H. Beynon (4) used partial budgets to demonstrate the effects of substituting home-grown foods for purchased concentrates. What then does this technique of budgeting involve, and of what practical value is it to the ordinary farmer?

Briefly, budgeting enables one to measure the effect that any change in the farm organization may have on the farm income (profit) *before* the change is made. It is also designed to give a *comparison* of the effect of alternative plans which may suggest themselves to the farmer. The complete budget deals with the probable total costs and returns of the *whole* of the farm organization: the partial budget deals with only the *extra* costs and returns incurred by a change in one or more departments of the farm. As such, it can be used extensively in farm planning.

The example that follows is one of the more complicated, but it illustrates well the use of the partial budget.

The Problem The Cattlegate Farm of Messrs. D. Williams and Co., at Northaw in south Hertfordshire, is geared for the efficient production of cereals. Because of its closeness to London, an adequate supply of skilled labour for handling a cash rootbreak is unobtainable. To maintain fertility and give a break between straw crops, leys of varying duration are taken round the farm, some 120 of the total of 340 acres being in leys. In the eastern counties generally, an acre of grass does not produce anything like the gross revenue (and consequently farm income) of an acre of arable land. This was so on Cattlegate Farm, yet the acreage of leys could not with safety be further reduced. How then could the leys be made to add more to the farm income?

The system in force until 1954 was to graze up to a maximum of 34 Friesian cows and a few followers under reasonably intensive conditions, with as large a tonnage of hay as possible (averaging 90 tons) being made. The winter feeding was hay plus wet grains for maintenance with a home-made concentrate at 4½ lb. for every gallon of production. The herd average was about 750 gallons of milk sold per cow per year. As with most herds in the area, the aim was winter milk. The cows were milked by bucket plant in a double-rank shed holding thirty-four. The dairy was placed separately to one side across the yard. Its old-fashioned design required all feeding and mucking out to be done with a hand barrow, and during the winter three men were needed full time to see to the herd. There was the further problem that the shed was not suitable for T.T. milk production, so alterations for that purpose were due to be made sooner or later.

The Proposal There is a tradition of milking cows on Cattlegate Farm and it seemed therefore that the increased income could best be obtained through the dairy stock. Beef production did not appeal since it lacked intensity, and sheep were out of the question because of the dog menace. Two ways were apparent: the milk production from the grass could be increased by keeping extra cows, or the grass could be used to replace more expensive food; or the two methods could be combined. There seemed to be most opportunity for both items in the winter period, and so silage-making and feeding came to be considered. But the mere thought of hauling silage into the existing cowshed was depressing. So a fresh idea was conceived. Why not yard the cows to self-feed the silage and install a milking parlour, so that at one stroke feed costs might be cut, more cows kept, less labour used, and the conversion to T.T. premises made?

It so happened that during the winter of 1953-54 some careful measurements made on the farm of a pioneer self-feeder, Mr. Allan Sapsed of High Heath Farm, Codicote, Herts, had shown that his Friesians over a period of thirty days had consumed an average of 119 lb. per head per day without waste and that the allowance of 6-8 inches of face (chopped material) per cow was adequate. Further, maintenance plus the first two gallons of production had been got from this silage. A mixture of oats and beet pulp were fed for the third gallon and balanced concentrates given beyond that. There was no difficulty about high yielders giving 7 gallons daily having room for their concentrates. There had been no drop in the daily total at the changeover to self-feeding, and the cows milked well throughout the late winter on this high silage diet and finished in good condition.

This was something to work on. After some thought a plan was drawn up for converting the existing cowshed into the covered portion of a yard,

with a tandem parlour and new dairy at one end. One wall of the yard was to be silage made in surface silos with ramps at the rear. It was calculated that 300 tons of silage would be needed to take a larger herd (40 cows) through a 22-week "winter", and that this could be obtained from the acreage previously mown for hay. Sales of surplus hay would cease and a forage harvester would be needed for the silage-making. A four-wheel-drive tipping lorry, which was to be bought for grain and general carting, would be used for green crop carting too. A new milk cooler would be needed, since the water supply was not adequate. As the herd was chiefly autumn calving, it could be assumed that during the self-feed period the cows would get maintenance and the first two gallons of production from the silage, so saving concentrates. There would be little difference in fuel costs between hay and silage-making, no extra labour would be needed, and in winter only two men would be needed to look after the cows.

Pounds, Shillings and Pence The proposal seemed technically safe and highly desirable to the owners, but was it financially sound and would it increase the income from grass? This was where budgeting came into the picture. The partial budget for the proposal, in two parts, is given below. First, there was the budget for the changeover to a self-feeding, yard-and-parlour system for the existing 34 cows.

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Revenue Forgone		Costs Saved	
Surplus hay 30 tons @ £8	240	Concentrates for 34 cows: 2 gallons per cow for 154 days=21 tons @ £28	588
		Wages: 1 man for 26 weeks @ £5 10*s.*	143
Increased Income	219		
	731		731

Secondly, there was the budget for the six extra cows introduced into the herd.

Increased Costs	£	Increased Revenue	£
Extra concentrates:		6×750 gallons @ 3*s.*	675
6×200 gallons=2½ tons @ £28 ...	70	2 cull cows @ £30	60
Herd replacement:		5 calves @ £5	25
2 cows @ £90	180		
Miscellaneous:			
6 cows @ £10	60		
Increased Income	450		
	760		760

The saving in wages claimed is justifiable, because the time saved would be usefully taken up on an expanded poultry enterprise. The six extra cows could readily be found grazing and silage if the housing problem was overcome, and they could be handled easily by the staff allowed.

These budgets showed that despite the fairly heavy costs of the change, the result was likely to be well worth while. A much more efficient unit would bring an increased income of nearly £670 a year—this is equal to an extra £16 per cow (40 cows), or an extra £6 per acre of grass or 24 per cent on the extra capital invested in machinery, buildings and stock. Had it been the practice to feed bought concentrates, the income would have been up by a further £140.

Although it might be argued that a drop in milk prices could render the calculations invalid, they show that the new system, when installed, would enable Messrs. D. Williams and Co. to absorb a substantial fall in the price of milk and be no worse off than they were before the change. In fact, it is unlikely that milk prices would fall alone. The costs of feed, replacements, etc., would undoubtedly decline also, so that the relationship between costs and returns would remain approximately the same. The proposal therefore seemed to be very encouraging. But would any other arrangement be as good?

An Alternative Arrangement The alterations envisaged so far entailed a complete rearrangement of the dairy unit and practice. If, however, the existing shed were extended and brought up to T.T. standard, a new dairy built, a new cooler installed, silos erected and silage made as already provided for but hauled to the cows in the winter, what would be the effect of that on farm income? The calculation, in one part, is again fairly simple.

Increased Costs			£	Increased Revenue	£
Depreciation and repair on machinery:				Extra revenue from six cows, as before	760
Forage harvester	£300	@ 20%	140		
Ex W.D. tipper, ¼ of cost	£100				
Dairy machinery	£300				
Building Work:					
Alterations and silos 10%	£1,900	@	190		
Extra costs for six cows, as before			310		
Revenue Forgone				Costs Saved	
30 tons hay @ £8			240	Concentrates for 34 cows, as before	588
Increased Income			468		
			1,348		1,348

Hauling the silage to the cows meant that three men would be needed, so no saving in wages was possible. This, together with the higher building cost, accounts for the smaller income from this proposal. There is the further implication that the expansion of the poultry enterprise could not take place. By making a few simple alterations in this budget, it is possible to show that another course—namely, an improved shed for 34 cows fed on silage—gives an increase in income of £186. None of the possibilities, however, is as good as the yard and self-feeding in terms of increased income. The further "non-monetary" consideration of the extra work

involved in hauling silage, straw and dung in a cowshed also weighed heavily with the owners. The decision to yard and self-feed was therefore easily made.

Successful Changeover In the early spring of 1954 the alterations were made, machinery bought, and the silage made. Due to the change to attestation there was a reduction in stock, so that in the winter of 1954-55 only 20 cows were self-feeding. They ate rather raggedly, since there were not enough of them for the face allowed; but even so there was little waste. Maintenance and two gallons of production were obtained without difficulty. They were milked twice daily and beyond that required little attention.

It was a source of satisfaction to Messrs. D. Williams and Co. to know that *before they started* it had been shown logically and convincingly that the scheme was likely to be financially sound, despite its seemingly heavy demands on capital, and that it was the best of the alternatives investigated.

It should be clear that the best solution for this particular farm may not be the best for others with a similar problem. Circumstances vary from farm to farm, and individual budgets should be drawn up. The real value of partial budgeting lies in the fact that any farmer or adviser can use it to forecast the likely effect on farm income of any proposed changes in farm organization. It seems likely that in future everyone connected with our industry will have to think more about considerations of this kind.

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REPORT ON THE ANIMAL HEALTH SERVICES IN GREAT BRITAIN, 1954

The Report on the Animal Health Services for 1954 shows that outbreaks of the more important notifiable diseases of livestock during the year were far fewer than in 1953. There were only twelve outbreaks of foot-and-mouth disease (the lowest for twenty-four years), and the number of cases of swine fever and anthrax fell by about a half. Outbreaks of fowl pest amounted to 795, compared with 978 in 1953; and for the second year in succession no sheep scab was recorded. Satisfactory progress in the campaign against bovine tuberculosis is reported; by the end of 1954 more than half the cattle in Great Britain were in attested herds.

Other topics dealt with in the Report include the new policy of segregating "clean areas" from the rest of the country in the campaign against fowl pest; the confirmation of the first case of atrophic rhinitis in pigs in this country; a new code regulating for disease purposes the importation of carcasses and animal products; the measures for the protection of animals in transit; and animal health questions in connection with the export trade. Full accounts are also given of the research work carried out by the Veterinary Laboratory, Research and Investigation Services.

Copies of the Report are obtainable from the Sale Offices of H.M. Stationery Office, or through any bookseller, price 4*s.* (4*s.* 2*d.* by post.)

THE RIGHT PIG

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Dr. John Hammond, who was a member of the Howitt Pig Production Committee*, points to the specific requirements of the specialized pork and bacon markets and offers some advice as to the best way of producing the right pig for the right market.

WITH pigs, as with milk, there is more than one market. With milk, it is the liquid milk trade which is most profitable, for the whole milk is sold direct to the public without processing. A lower price is given for manufacturing milk, for it has to be processed for consumption as butter or cheese and only part of the product is sold for direct consumption. It is much the same with pigs. Suitably bred and fed, pork and bacon pigs can be sold direct to the consumer with the minimum of by-products, but pigs unsuitable for these markets have to be trimmed and parts go to the manufacturing trade; they therefore command a lower price. It follows that the nearer our pigs conform to the requirements of the pork and bacon markets, the higher the price the pork butcher and the bacon manufacturer respectively can afford to give for them. When the manufacturer has, after processing, to sell his product (loins of pork, pickled pork, sausages, canned meat, etc.) in competition with fresh meats, he cannot afford to pay the farmer so much for his pigs, especially as some of the by-products of this processing, such as lard, now command but a low price, owing to the competition with vegetable cooking fats.

What is Wanted Provided the right sort of pig can be produced, there are two circumstances which favour the pork market. First, rationing during the war has done much to break down the prejudice against pork when there is not an "r" in the month, although sales are still depressed in very hot weather. Secondly, the amount of beef coming in from the Argentine—formerly our main supplier—is small and we now have to pay for it in materials, instead of receiving it as interest on capital, as happened before the war. If the right kind of pork pig can be produced now, there seems to be no reason why pork should not permanently replace some of the beef in our national diet. This happened many years ago in Germany and has been happening in the U.S.A. over the last fifteen years or so. How far this replacement of beef by pork will go depends on the quality of the pork and on the price at which it can be produced.

There are two main sections of the pork trade. The first is the porker pig—an animal of about 65-80 lb. carcass weight (90-115 lb. live weight) which can be cut up and sold for weekend joints, such as loin and legs, with the crackling on. It is therefore very necessary in this class of pig that the fat cover should be just right, since trimming reduces the value. The legs, too, should be short-boned and plump.

This type of pig was absent from our markets during the war and is now only just beginning to return. There is a limited demand, chiefly for the London and South Wales markets, but it commands a high price. The chief defect found in those that are being marketed now is that the depth of flesh

* The Report of the Howitt Committee on the Development of Pig Production in the United Kingdom (Cmd. 9588) was published on October 20. Copies may be obtained from Sales Offices of H.M. Stationery Office, or through any bookseller, price 3*s*. (3*s*. 2*d*. by post).

is inadequate and the proportion of bone is high. The type of pig best suited to this market is an early-maturing type which has been grown quickly on a good milk supply from birth. Even for this class of pig, more body length (but not leg length) is required than is usually found in these types, for the loin is the most valuable joint. It is, however, rather an expensive pig to produce, as overheads on the cost of keep of the sow are high.

The second section involves a pig of about 80-130 lb. carcass weight (120-160 lb. live weight) which will provide pork chops, etc., for sale during the week. For this class a pig with a long, deeply-fleshed loin is required, but one which does not carry too much fat, for the more fat which has to be trimmed off the chop the lower the price that can be offered to the producer for it. The shorter the bone and plumper the leg the better, but this is not so important as having a long loin. A heavy shoulder and great depth through the heart line at this weight are grave defects, since they increase the proportion of the low-priced joints. The optimum carcass weights for these pigs vary slightly in different districts, being 80-100 lb. in London and the south and 110-130 lb. in the North and Midlands (the heavier ones often being termed "cutters"). The type of pig that fits this trade well is a moderately early-maturing type which fleshes well. To obtain the necessary depth of flesh, the pigs should be grown quickly without any check from birth, but should not be allowed to get too fat. This may easily happen in the shorter type of pig, and since the rate of fat deposition increases with weight, the shorter pigs should be marketed at lower weights if the best quality carcasses are to be produced.

The Bacon Pig. For bacon, a pig of about 140-170 lb. carcass weight (200-220 lb. live weight) is required. Here again, as the bacon is to be sold with the rind on, it is essential that the thickness of fat should be just right, for surplus fat cannot be pared off before sale. The present grading of bacon pigs therefore takes account of this back fat. Grading on back fat only, however, does not meet the bacon factory requirements if they are to compete with imported Danish bacon. Not only has the bacon to suit the consumer in the proportion of lean to fat, but the side has to have proportions which will leave a profit to the retailer when it is cut up. The bacon factory has therefore to regrade the A carcass before selling them as No. 1 sides to the retailer. The chief causes for the rejection of A carcasses from the No. 1 bacon selection are lack of length, heavy shoulders from too great a depth of rib behind the shoulder, which makes the belly rasher too long to be saleable. The length of rib is a late-developing part of the skeleton, and in breeds which mature too early the ribs are therefore rather long in proportion to length of side, which is an early-maturing part.

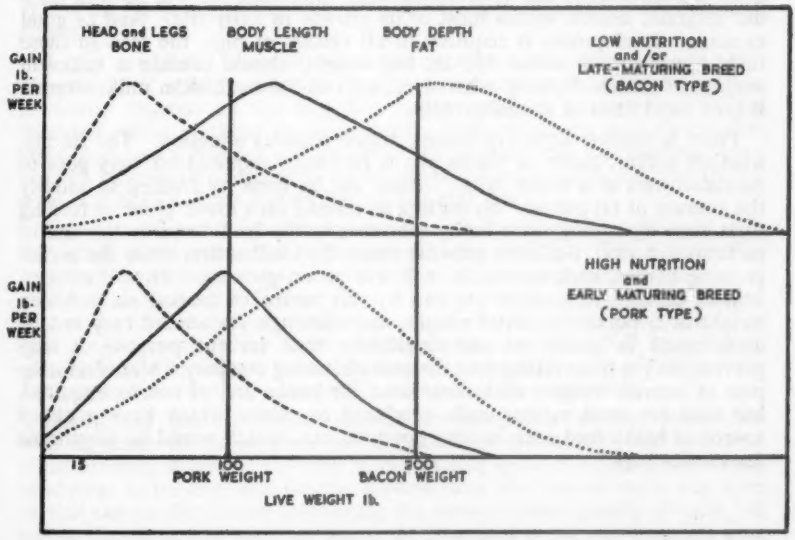
The Manufacturing Pig. Pigs other than those specified above are used for manufacturing purposes. They consist mostly of pigs which are too heavy or too fat, or which have unsuitable conformation. As with pigs going to American packing-houses, the manufacturer achieves, by trimming and working up the trimmings into other products, what the breeder and feeder fail to do. Unfortunately, too many of our pigs today fall into this category.

How to Produce It To produce what the market requires, both breeding and feeding have to be right. To ensure profit, however, other things must also be taken into consideration. Of these, perhaps the mothering qualities of the sow are most important, for the number of

pigs weaned per litter and the weight of those pigs at weaning reduce the overheads on the breeding stock. This factor increases in importance as the weight of the pig at sale decreases; that is, it has a greater bearing in porker pigs than in baconers, although it is important in all pigs. The main object of the Pig Recording Scheme is to help breeders measure these mothering qualities of the sow and select their stock for good mothering ability. Of course, the Scheme does other things too, in that it helps the producer to pinpoint defects in feeding and management, such as a poor arrangement for creep feeding or cold, draughty buildings for the young pigs. Both these lower growth rate and increase the time taken to reach marketing weights. The weighing machine is even more valuable to the pig producer than it is to the milk recorder, for it records not only the growth rate of his pig but also the weight at which it is most profitable for him to market it. By slightly reducing the live weight at which their bacon pigs have been sent in, many producers have raised their grading results. The weighing machine soon pays for itself.

As the pig grows up it not only increases its size but it also changes its shape and composition. It is these changes in shape and composition that are important for carcass quality. At birth the pig is short and heavy in the fore-end. As it grows up it first lengthens out and later deepens, and the more it lengthens the less in proportion the fore-end becomes. During the lengthening process it is growing bone and muscle while, when it begins to deepen, fat is put on at an increasing rate.

Breeds, and individuals within a breed, differ considerably in the rate at which these changes occur. The diagrams which follow illustrate the differences between an early-maturing type (*below*) which will have the right proportions of fat, muscle and bone to suit the porker trade if killed at 100 lb. live weight, and a later-maturing type (*above*) which will have the right proportions of fat, muscle and bone to suit the bacon trade at 200 lb. live weight.



Diagrams showing how the changes in body form and composition are brought about by differences in the time and rate of growth of different parts and tissues of the body.

The medium-weight pork pig comes about halfway between these two. It will be seen from these diagrams that if the porker-type pig (*below*) is kept to bacon weight it will be too fat to suit the bacon trade, whereas if the bacon type (*above*) is killed at porker weight it will have a rather high proportion of bone (although this is perhaps the lesser evil of the two).

These early- and late-maturing types of pig can be selected by breeding. Each breed society should make up its mind which of the three markets—porker, cutter or bacon—it intends to specialize in; otherwise most of its pigs will go for the manufacturing trade at a lower price. If within a breed some members breed for one market and others for another, the breed will soon become a no-purpose or manufacturing breed. As with our cattle, where breeds are specialized for butter fat, milk or beef, so pigs require to be bred for a specific market. The problem of breeding pigs for a specialized market is very much like that in cattle—selecting animals for breeding purposes from those which have had a progeny test to show how they are transmitting the qualities required. For this purpose, National Progeny Testing Stations for pigs are now being set up to find, under standard feeding conditions, the boars and sows of the different breeds which are breeding well for the commercial characters of quick growth rate, good food conversion and carcass qualities suited to the market required. The carcass qualities demanded by the different markets have already been detailed.

Correct Feeding is All-important Many a pig well bred for a specialized purpose is spoilt by the method of feeding and management. If the breeder is to be able to find out the genetic possibilities of his stock, he should feed and manage them properly, otherwise their good breed characteristics will not show themselves.

As for all three purposes—porker, cutter and baconer—body length is required, and since this is made during early life, the young pig should be given a good start in life by creep feeding. Moreover, as will be seen from the diagram, muscle makes most of its growth in early life. And as good muscular development is required in all classes of pigs, the feed in these early stages (up to about 120 lb. live weight) should contain a sufficient amount of muscle-forming substances, such as fishmeal, skim milk, vitamin B_{12}, or some form of animal protein.

There is another aspect of feeding which requires attention. The fat pig, whether porker, cutter or bacon pig, is no longer required—it only goes to manufacturers at a lower price. Much can be done by feeding to modify the amount of fat put on. By putting an animal on a lower plane of feeding (best done by adding some bulky substance to the feed) towards the end of its feeding period, the latest growing tissue (fat) will suffer, while the earlier growing tissues, such as muscle, will still go on growing. Thus if circumstances demand it, a cutter pig can by this means be carried on to bacon weight or a porker to cutter weight, and although the animal may not be quite equal in quality to one specifically bred for the purpose, it may prevent the pig from falling into the manufacturing category. Manufacturing pigs of heavier weights than those used for bacon are, of course, required, but they are most economically produced on farms which have a cheap source of bulky feed such as chat potatoes, etc., which would be unsuitable for smaller pigs.

THE SOLIDS-NOT-FAT PROBLEM

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The solids-not-fat fraction in milk is of the greatest importance nutritionally. Professor Kay's examination of the factors influencing its levels will therefore be of exceptional interest to all dairy farmers.

WHEN, in 1945, the attention of various individuals and organizations concerned with milk production was drawn by the N.I.R.D to the decline in the average content of butter fat and solids-not-fat (S.N.F.) per gallon (a decline apparently in progress since the early 1930s), their first reaction was one of surprise. Some doubted whether a decline had, in fact, taken place. Further examination of the available figures by competent investigators confirmed this disquieting fact and indicated that the decline was more pronounced in S.N.F. than in fat content. Further, during the 1940s and since, an increasing number of milk collecting depots and dairies have been finding that in the late winter months (and, in some of the eastern districts, in the late summer), the average compositional quality of the milk received from their responsible producers is so low that the average *bulked* milk of the dairy may, in some cases for weeks at a time, be below the legal (presumptive) standard of 8.5 per cent of S.N.F. Thus not only is the consumer at such times getting an article of diminished nutritional value, especially since the fall is mainly borne by the protein fraction of the non-fatty milk constituents, but the distributor of the milk is in danger of prosecution on the presumption that he is selling milk to which water has been added.

As the nutritional value of milk to the consumer obviously depends on its compositional quality, and the existence of the milk industry no less obviously depends on the fact that normal milk is an excellent human foodstuff, most of those in the industry, milk producers and distributors alike, and also a number of dairy research workers and nutritionists—have become increasingly concerned about compositional quality, particularly the level of S.N.F. and the factors influencing that level.

It is becoming more widely known that for the consumer of liquid milk the S.N.F. are more valuable nutritionally than the fat. The high quality proteins, the valuable salts and the five or more water-soluble vitamins of milk are all in the S.N.F. fraction, a fraction that contributes some 70 per cent of the total weight of nutrients in a pint of milk. If need be, the fat of milk could be replaced by fat from other sources, but the S.N.F. constituents of milk would be difficult indeed to replace either in the diet of the growing child or in that of other " vulnerable groups " of the population.

During the last ten years, several knowledgeable articles have been written, much correspondence has appeared in the farming and technical press, farming advisers have been facing a rising spate of inquiries from milk producers in trouble, and fruitful experimental and survey work has been carried out on the factors influencing the compositional quality of milk. It seems, therefore, that after ten years, the present is a not inappropriate time to take stock of the present situation, to summarize what we know about the more important factors influencing the composition of milk, particularly

those influencing the level of S.N.F., and to consider what might be done to remedy present defects.

Acute Shortage of Records A serious handicap at the outset is that extremely few herds, even today, are regularly recorded for S.N.F. For records of *volume* we have plenty of data—some 25,000 herds out of 160,000 are regularly recorded; for fat content, less data exists but enough to form a reasonably adequate basis for studying changes and factors affecting them, and for selecting bulls; for S.N.F. content, we have a body of data obtained during experimental work, but next to no regular records—quite insufficient, for example, to assist in the choice of bulls. Only one or two herds in the whole country have regular S.N.F. records extending over a long period of years, the N.I.R.D. herd at Shinfield being one of these, with records for volume, fat and S.N.F. going back to 1924. Existing records are almost entirely those rather randomly compiled in milk-collecting depots or dairies or in public analysts' laboratories.

Nevertheless, the experimental data provide us with well-established correlations between variations in the percentage of S.N.F. in milk and certain other variables, particularly breed, stage of lactation, season of the year, age of the cow, presence or absence of mastitis. Fairly recent work has also shown clearly what was not known previously—that poor nutrition, in addition to its universally recognized effect in depressing yield, also depresses S.N.F. content. The depressant to compositional quality that was much in evidence in this country in the early part of the present century—the addition of plain water—can virtually be ruled out today. It is the experience of the majority of dairy laboratories that only in a very few cases does this particular variable still play a part. Using a quick freezing-point test, it was shown in two careful surveys in the 1940s, when, with demands for milk much greater than supplies and the temptation to add water was acute, that the amount of adventitious water in producers' milk was of the order of 0.6 per cent only.

Articles published in recent years[1, 2, 3, 4, 5] deal in some detail with the variations in S.N.F. mentioned above. In the rest of this article it is not proposed to do more than extract from the present body of detailed information the main conclusions and lessons regarding S.N.F. variations and their control; those who would seek further particulars are recommended to consult the five papers mentioned above and the relevant original sources quoted in those papers.

Influence of Breed There can be no doubt that the breed of the cow exercises a major influence over the percentage of S.N.F. in the milk. A table, derived in part from an N.I.R.D. survey in 1948 and in part from Milk Marketing Board figures of about the same time, gives the average S.N.F. content of milk from the main dairy breeds.

Breed	Solids-not-fat Percentage		
	N.I.R.D.	*M.M.B.*	*Average*
Friesian	8.59	8.58	8.585
Shorthorn	8.71	8.68	8.695
Ayrshire	8.78	8.73	8.755
Channel Islands	9.01	8.93	8.970

The two sets of figures, obtained quite independently, agree very closely. One interesting corollary from these figures is that, as regards S.N.F., the quality of the milk of *all* the main dairy breeds in this country has diminished over the last twenty or thirty years, that of the Channel Island breeds perhaps

even more markedly than the others. It is, however, quite clear that the average Friesian herd is much closer to the presumptive limit of 8.5 per cent than is the average Shorthorn herd, which is the breed next lowest in S.N.F. quality. In the average Friesian herd a fall of only 0.10 per cent is sufficient to bring it below the limit; in the Shorthorn herd a fall of practically twice that extent is required. In view of the well-known seasonal fluctuations in S.N.F. quality which occur with all the milk-producing breeds, the average Friesian herd is more likely to be below the legal standard for more weeks in the year than is the average Shorthorn herd, and still more likely to be below that standard than the average Ayrshire or Channel Island herd—a likelihood completely confirmed by the available figures from milk-collecting centres.

As is well known, the predominant dairy breed twenty years ago in England and Wales was the Shorthorn, and the greater part of the milk of this country was produced from Shorthorn or Shorthorn-type animals. Today, the predominant breed is undoubtedly the Friesian, and pedigree Friesians plus Friesian crosses provide far more of the national milk supply than do Shorthorn plus Shorthorn-type animals. That the movement Friesian-wards still persists is very clearly shown both by the recent breed demands at artificial insemination centres (and it is to be remembered that about half the cows of England and Wales are artificially inseminated) and by the number of bulls of different breeds now licensed by the Ministry. There can be no reasonable doubt that a large proportion of the modern low S.N.F. problem is due to this change over to the Friesian-type animal. This statement is not a criticism of the Friesian breed; some strains within the breed have milk compositional figures well above the average, and its enterprising breed society is making strenuous and apparently successful efforts to put up the *fat* percentage in Friesian milk by encouraging breeding from such strains. The Society would doubtless be doing the same for the S.N.F. percentage if a reasonable number of individual records were available, as it is virtually certain that high S.N.F. strains must exist. The statement is rather to be regarded as resulting from the quite legitimate desire of a large number of dairy farmers, under the present system of payment for milk on a volume basis, to obtain larger yields of milk per cow and cut down their overheads per gallon. Breeding for quantity, with little regard for quality, must be regarded as one of the major factors in the general fall in S.N.F. in the last two decades.

Influence of Disease For a long time it has been known that mastitis, even sub-clinical mastitis, associated with either streptococcal or staphylococcal infection, diminishes the compositional quality, particularly the S.N.F., of the milk of the infected quarter to an extent which varies approximately with the severity of the infection. Even if by using antibiotic or other curative treatment the infection in a quarter is got rid of, the particular quarter may still continue to secrete abnormal milk, short of lactose but containing excess of sodium chloride, for the rest of the lactation. A careful survey some twelve years ago when, before the advent of antibiotic treatment, streptococcal mastitis was almost certainly more prevalent than it is today, showed that quantitatively this group of diseases was quite a minor factor in diminishing the average S.N.F. content of the bulked milk of the national supply, though in single seriously infected herds, and still more of course in an individual cow, mastitis could easily be a major cause of low quality.

It can be said with confidence that udder disease is *not* the cause of the fall, mentioned in the opening paragraph, of S.N.F. in the last twenty years.

Influence of Feeding General experience, as well as carefully controlled experiment, during the last fifteen years, have shown beyond doubt that underfeeding is a major factor in reducing S.N.F., particularly in lowering the percentage of protein, in milk. Experiment has shown curiously enough that a diminution of calories (starch equivalent) in the diet is more effective in reducing the protein content of the milk than is an even greater (percentage) diminution in the protein content of the diet.

The late winter months is the time when most trouble is experienced; then both the quality and quantity of farm feedingstuffs are minimal, and on too many farms too many cows are hungrily consuming too little hay or silage, both of poor quality. When such cows are turned out on young grass in the spring, the S.N.F. of their milk (particularly the protein fraction), together, of course, with the yield, rises markedly. Even when cows are fed according to yield, and on good quality rations, the S.N.F. usually tends to fall during a prolonged winter-feeding period, though the fall is far less than that seen in a herd fed an insufficient or ill-balanced diet. Though the drive on most dairy farms during the war towards greater self-sufficiency as regards animal feedingstuffs has continued subsequently, yet even today both quantity and quality of home-produced fodders and feeds are on many farms still below the fairly high standard required to develop the full potential of the dairy stock on those farms, either for milk yield or milk quality. In relation to the maintenance during the winter months of S.N.F. values, the implementation on many dairy farms of modern methods both of conservation of high quality grassland products and of grassland management, is obviously of first importance; access to green fodder for as long a period of the year as possible and the winter feeding of balanced milk-production rations, containing concentrates where necessary, to dairy cows according to yield are highly desirable to minimize any threatened fall.

During summer droughts, conditions of partial starvation of dairy cows are far from infrequent, but are usually relieved, both as regards underfeeding and depression of S.N.F., by the autumn re-growth of herbage.

We still need to know more about what it is in young herbage that causes the rapid increase in non-fatty solids in milk. The effect is not wholly explicable by the luxus feeding and the excess of protein in the diet of grazing cows at that season of the year. There are also the change of environment, the fresh air and exercise; but these can play only a small part, since when freshly-cut spring grass is given to cows indoors the same effect of a marked increase in S.N.F. in milk is observed as if it had been grazed outside.

Practicable Steps to solve the Problem It has been irresponsibly said that, despite much research, we still know next to nothing about the factors controlling the level of S.N.F. in milk. This is simply not true; though admittedly a number of important problems remain to be solved, we already know many of the answers. We certainly know enough to be able to effect improvement in many, and rapid improvement in a large majority, of the herds in trouble, provided the advice is based on a study of the problem in its local setting and is acted on by those in a position to take action.

We also know enough to improve markedly the long-range status of S.N.F. in milk generally, though the successful implementation of that knowledge will cost effort and money.

There is probably need for a word of warning in those cases where the trouble is of genetic origin. It has been said that to breed for increased fat

percentage is automatically to breed for increased non-fatty solids percentage. If, in practice, this is intended to mean that if you use a Guernsey bull with high fat percentage in its ancestry on a Shorthorn herd, you will probably put up the S.N.F. as well as the fat, it is, in a general way, true. It is also true that if you use an average Shorthorn bull on a Guernsey herd the S.N.F. as well as the fat will probably go down. But within a breed, and still more within a herd, the positive correlation between fat and S.N.F. is low. In the absence of records for S.N.F., all that can be said is that if a bull with high fat records behind him is used, it is rather unlikely that he will depress, below that of their dams, the average of S.N.F. percentage in the milk of his offspring.

In conclusion, may I recall the recommendations of the Working Party on Milk Quality Production which were published in 1953. They are, in summary: (1) that effective use should be made of existing advisory services by those farmers in serious trouble with compositional quality, the Milk Marketing Board to take action, as it does with respect to keeping quality, when advice is persistently neglected; (2) that breeders of dairy bulls, and those responsible for A.I. centres, should pay as much attention to S.N.F. records as they do to fat records; (3) that Milk Recording Services should assist with (2) above by providing the necessary analytical services for S.N.F. determinations; (4) that continuous records of compositional quality (that is, fat and S.N.F.) should be maintained for all breeds and for all parts of the country.

If these cautious and practical proposals were acted upon, there is little doubt that they would, in the course of a not inconsiderable time, lay the foundation for better compositional quality in the national milk supply.

If, however, fairly quick action is desired, to give the *present* generation of housewives a better article, it is my firm opinion that, as has been shown not only in other countries but also in the past by some of our British creameries, an equitable and fairly inexpensive scheme for payment to the producer on a basis of milk quality could be readily devised and introduced and would bring the desired results within a very few years. It would be welcomed by many dairy farmers and milk distributors who see the dangers in the present situation.

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UTILIZATION OF GRASSLAND (1)

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Paper delivered to the Agriculture Section of the British Association at Bristol, on September 1, 1955.

IF full use could be made of the food nutrients produced by the grasslands of the world, then there would be food in abundance, and at the lowest cost, particularly the animal products which are in greatest demand today. Something like two-thirds of the agricultural land of the world is in permanent meadows and pasture, and the proportion under grass is even larger when account is taken of the acreage of temporary leys in the arable rotations of many countries. In the United Kingdom more than half the food nutrients obtained from our own soil comes from grassland. Of our 31 million acres of agricultural land, over 19 million acres are in grassland, and there are in addition 17 million acres of rough grazings. Grass is the raw material from which we get much of our milk, meat, butter, cheese, etc., but in converting grass, or indeed any other form of livestock feed to the animal products which we require, there is a substantial loss of nutrients.

The efficiency of conversion of animal feed by different types of livestock is illustrated in Table 1.

Table 1

Efficiency of Animal Production
(After Dr. J. Hammond)*

Product	Protein Conversion Efficiency *per cent*	Energy Conversion Efficiency *per cent*
Milk (3 lactations)	17.0	30.0
Eggs (2 years)	33.1	22.1
Beef (grass fattened to 10.7 cwt.)	7.3	15.1
Pork	13.8–16.0	34.4–39.4
Lamb	5.9	9.6

The facts brought out in this table are of the utmost importance in relation to future world food supplies. It is known that as real incomes and standards of living increase, dietary customs change and gradually people eat less tillage crops and more animal products. The trend is for the consumption of cereals and potatoes per head of population to fall and that of meat and dairy produce to increase. This trend in dietary habit will put an ever-increasing strain on the supply of basic food nutrients because such a high proportion of these is lost in conversion to the finished animal products. In a world whose population is expanding at the rate of two million per month, the need to make the most efficient use of grass, the acreage of which exceeds that of all other crops combined, is self-evident.

To come nearer home, it is now accepted that to make better use of our grasslands is an economic necessity. Yet at a time when balance of payments fears are growing daily, our expenditure on imported animal feedingstuffs has increased by £55m. in the last two years, and much of this could have been supplied at very much lower cost by better utilization of grassland.

* Livestock Improvement. J. Hammond. *Seale-Hayne Agric. Coll. Bull.* 1950.

UTILIZATION OF GRASSLAND

Grass well managed can produce greater yields of nutrients for livestock than almost any other crop, and the cost of grass nutrients is low compared with those obtained from any other source, as is seen from Table 2.

Table 2
Estimated Cost of Starch Equivalent for Various Crops and Dairy Cake in 1954

	Average Yield per Acre *tons*	Cost of S.E.* *£ per ton*
Grazing (effective production)		11
Early-bite (effective production)		14
Grass silage	5.2	17
Kale, grazed	14.0	17
Kale, cut	20.0	18
Hay	1.7	20
Oats, half straw-fed	1.2	28
Fodder beet, roots	12.0	33
Tillage silage	6.0	34
Dried grass	1.6	40
Mangolds	25.0	40
Dairy cake at £35 a ton (65% S.E.)		54

*S.E.=Starch equivalent, which is the number of pounds of starch necessary to produce the same amount of fat as 100 lb. of the food.

These figures show that grass consumed as grazing is by far the cheapest feed for ruminants, that conserved grass is cheaper than most other feeds, and that all forms of grass are substantially cheaper than purchased cake. It will clearly be to the advantage of the livestock farmer to achieve the highest possible output from his grassland and provide as much as possible of the nutrient needs of his stock through grazing.

Output from Grassland At this point I should like to make a brief reference to grassland output. Unfortunately, in considering this matter we are soon in difficulty because of the lack of a suitable method for measuring grassland output which is generally applicable. Where only one type of livestock is used to consume grass, and where the livestock are fed entirely from the grass, there is no problem; but in general, grass is consumed by a variety of livestock of different ages, and frequently other foods are used to supplement the grass and the problem becomes much more complicated. To try and assess grassland output by measuring weight and composition of grass produced is seldom satisfactory and often misleading.

The method of measuring grassland output which is in most general use aims at assessing the output of utilized nutrients in terms of starch equivalent. An estimate is made of the total food required by the stock consuming the grass and from this is subtracted the nutrient value of any other foods which have been fed, and the difference is considered to be the contribution from grass in terms of starch equivalent. This method for evaluating grassland output has many shortcomings but it is one of the most useful available for comparative purposes.

Using this method, an O.E.E.C. Working Party, in a recent survey of pasture and fodder production in North-West Europe, arrived at the estimates for average grassland output in the countries surveyed given in Table 3 overleaf.

For comparative purposes, the average yield of barley (20 cwt. per acre) in the United Kingdom in 1952 was equivalent to 14.2 cwt. starch equivalent per acre.

Table 3
Estimated Production from Grassland, 1951-52
(O.E.E.C.)

Country	S.E. per Acre *cwt.*
Netherlands	26.2
Denmark	22.3
Belgium	20.0
Norway	19.0
W. Germany	17.2
U.K.	16.7
France	11.1

Grassland output in the Netherlands is by these standards reasonably satisfactory and is equivalent to a yield of about 37 cwt. of barley, but output of grass in several other countries, including the United Kingdom, is still low, and there is a weight of evidence to indicate that much higher production is possible. For example, one group of 47 farms in the United Kingdom for which detailed records are available recorded an average yield of 23 cwt. utilized starch equivalent per acre over 7,000 acres of grassland in 1953: some of the farms exceeded 30 cwt. per acre, and two farms exceeded 35 cwt. per acre. Further records show that one small 32-acre farm achieved an output of 42 cwt. utilized starch equivalent per acre. Few arable crops will produce yields of this order.

What is the secret of the high output from grassland on these latter farms? Is it that their conditions are more suited to high grass yields than most other farms? Almost certainly not. They undoubtedly grew good crops of grass, but above all they made the most efficient use of the grass they grew.

High output from grassland means growing a good crop of grass and making the best use of it, and in the present state of our knowledge the latter part of the procedure demands greater thought, skill and planning than the former. This fact is well demonstrated by a quotation from McMeekan* in respect of New Zealand grassland. He writes:

> Measured annual yields from good quality dairy pastures in New Zealand approximate 9,000 lb. dry matter per acre. Though perhaps the most highly specialized grassland dairy country in the world, the average yields from such swards today is only 150 lb. butter fat per acre (300 gal. at 5 per cent B.F.)—an efficiency of conversion index of 1 lb. butter fat from 60 lb. pasture dry matter. Even a low-producing dairy cow yielding only 300 lb. butter fat (600 gal. at 5 per cent B.F.), needing and consuming 9,000 lb. of pasture dry matter in the process, has an efficiency index of 1 lb. of butter fat from 30 lb. of dry matter. Thus even in one of the best environments, utilization is only 50 per cent of the potential.

Obviously full use is not being made of all the grass which is grown. McMeekan has aptly remarked: "Pasture is useless unless usable".

Part 2 of this article will appear next month.

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* Fifth Hudson Lecture delivered to the Wellington Branch of the Royal Society of New Zealand on August 26, 1953 and printed in *New Zealand Science Review* 1953, 11, 115-21.

FREQUENCY OF SUPERPHOSPHATE DRESSINGS ON PERMANENT PASTURE

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On pastures where the rate of decline in the availability of applied phosphate is rapid, some advantage may be gained by more frequent applications of superphosphate.

IN a review of phosphate usage in Great Britain, Stewart (1) observed: "It has long been the practice of many British farmers to pin their faith on the application of single, relatively heavy dressings of phosphate at intervals of a few years, in the general and rather pious hope that they were thereby creating a useful working reserve of phosphate in the soil". Although farmers are now frequently recommended to apply phosphate to grassland in smaller dressings at shorter intervals (usually annual), experimental evidence on the best intervals of application is conflicting.

In 1952, an experiment was laid down on permanent pasture overlying chalk at the Grassland Research Institute, Hurley, to measure differences in herbage output and botanical composition following dressings of superphosphate at three intervals and at two levels of application. The field had been ploughed and cropped for cereals early in the Second World War; it was returned to grass in 1943. In 1952 the soil was markedly deficient in phosphate and the sward in poor condition; the dominant species were creeping bent and red fescue, with a high proportion of herbs. The treatments were:

Treatment	Dressing of Superphosphate (19% P_2O_5) *cwt. per acre*	Date
a	9	March 1952
b	3	
c	3	March 1952, 1953, 1954
d	1	
e	1	March, June, September 1952, 1953, 1954
f	⅓	

All the plots received 1 cwt. per acre muriate of potash (50% K_2O) in March 1952, 1953 and 1954. The series also included phosphate only, potash only, and control treatments (see g, h, and i in table). All plots received 2 cwt. per acre "Nitro-Chalk" in April and a further 2 cwt. in August every year. The 25 yard × 15 yard plots were duplicated in two randomized blocks, and were grazed by sheep between April and October. The experiment was grazed four times in 1952 and 1953, and five times in 1954.

Experimental Results at Hurley The table gives the yield of crude protein and phosphate recovered in the herbage, and the proportions of main species groups at the end of the trial. No significant differences in crude protein output occurred in 1952. In 1953 and 1954, at both levels of superphosphate (that is, 1 and 3 cwt. per acre per year), the thrice-yearly dressings gave higher yields than other treatments at the same level. This was also true for total crude protein over three years. At the high level (9 cwt.), *total* yield from a single initial

dressing was higher than that from annual dressings, but the difference between these treatments at the low level (3 cwt.) was small. The best treatment increased the yield of crude protein by approximately 80 per cent.

Summary of Herbage Yield and Botanical Composition following Phosphate and Potash Dressings

Treatment		*a*	*c*	*e*	*b*	*d*	*f*	*g*	*h*	*i*
Superphosphate (*cwt. per acre*)	1952	9	3	3×1	3	1	3×$\frac{1}{3}$	1	—	—
	1953	—	3	3×1	—	1	3×$\frac{1}{3}$	1	—	—
	1954	—	3	3×1	—	1	3×$\frac{1}{3}$	1	—	—
Muriate of Potash (*cwt. per acre*)	Annual	1	1	1	1	1	1	—	1	—
Crude Protein Yield (*lb. per acre*)	1952	438	390	402	410	375	386	333	334	328
	1953	468	408	533	394	395	410	332	316	264
	1954	574	543	682	491	486	552	381	379	299
	Total	1,480	1,341	1,617	1,295	1,256	1,348	1,046	1,029	891
Phosphate Yield (*lb. P_2O_5 per acre*)	1952	35.2	20.9	18.3	20.9	16.4	16.9	15.2	13.1	13.8
	1953	21.3	18.8	22.8	14.9	13.6	15.0	13.2	9.7	8.8
	1954	25.5	27.5	31.7	16.8	19.4	22.5	17.5	13.8	11.1
	Total	82.0	67.2	72.8	52.6	49.4	54.4	45.9	36.6	33.7
Proportions of Total Cover in October 1954 (*per cent*)	Grasses	64.0	61.2	68.1	57.9	51.9	64.7	52.4	48.2	44.1
	Legumes	6.4	8.7	9.5	5.1	8.9	6.8	6.8	2.1	1.4
	Herbs	29.6	30.1	22.4	37.0	39.2	28.5	40.8	49.7	54.5

Standard Error of Crude Protein Yield:

1952 ± 25.4 lb. per acre. 1954 ± 27.2 lb. per acre.
1953 ± 27.6 lb. per acre. Total ± 53.7 lb. per acre.

Herbage phosphate yields in 1952 bore a close relation to the amount of superphosphate applied in that year. Differences within any one level were small in 1953 and 1954, but showed a slight advantage in favour of thrice-yearly applications. Taking the three years together, the highest output of herbage phosphate was obtained from plots receiving 9 cwt. of superphosphate in 1952. All high-level treatments raised the total phosphate yield by more than 100 per cent.

Plots receiving heavy phosphate dressings began spring growth early. The average dry matter yield in 1953 and 1954 from all high-level phosphate treatments was 1.36 times that from the potash-only treatment. When the same comparison is made for the yield at the first grazing only, the ratio is 1.72:1. Thus the effective grazing season was lengthened by phosphate applications; this was most noticeable when the fertilizer was applied three times a year.

Superphosphate increased the proportions of grasses and legumes, and reduced the proportion of herbs. These changes were most marked when the fertilizer was applied three times a year. However, creeping bent and red fescue remained the dominant species in all plots. Superphosphate affected individual species in the following manner:

Favourably. Cocksfoot, red fescue, tall oat grass, rough-stalked meadow grass, Yorkshire fog, perennial ryegrass, wild white clover.

Unfavourably. Creeping bent, self-heal, hawkbit species, other herbs.

No Measurable Effect. Smooth-stalked meadow grass, ribwort plantain, bulbous buttercup.

The superiority of the single heavy dressing over annual dressings at the high level appeared to be due to the initial phosphate deficiency of the pasture. In 1952 there was a good response to applications up to 9 cwt., but in subsequent years the yield from annual dressings at both levels approached that from the corresponding single dressing. The treatments are to be repeated over a further three-year period, and now that the initial requirements of the pasture have been satisfied, the immediate response to the single heavy dressing will perhaps be less.

Thrice-yearly Dressings best on Calcareous Soil The comparison between annual and thrice-yearly dressings was made over three complete cycles of application, the last two occurring after the original deficiency had been corrected. An examination of dry matter yields and herbage phosphate content at each sampling date showed that the superiority of thrice-yearly over annual applications, in the last two seasons, could be explained satisfactorily on the basis of a limited response to the single annual application coupled with a rapid decline in the availability of the applied superphosphate.

It appears that some advantage may be gained by short-interval phosphate applications on a calcareous soil where the decline in availability is rapid. Hudson and Doak [2] recorded a similar increased response to thrice-yearly applications in New Zealand. From the point of view of economy in fertilizer use for the same level of output, it can be seen from the table that the total crude protein yield from thrice-yearly dressings of ½ cwt. was equal to that from annual dressings of 3 cwt. of superphosphate.

The results obtained at Hurley also indicate that, in the improvement of pasture on phosphate-deficient calcareous soils, a suitable programme of phosphate manuring would comprise a heavy dressing in the first year and, in subsequent years, light dressings at intervals throughout the season. On pastures already adequately supplied with phosphate, the initial heavy dressing might be omitted.

The application of nitrogenous fertilizer to grassland at least twice in the season is fairly common practice. But we are accustomed to think of nitrogen as the only main fertilizer element requiring frequent and carefully timed application, whereas on certain soils it would seem advantageous to give similar consideration to phosphate. By the use of compounds, the nitrogen practice could, in fact, be extended to phosphate, and perhaps to potash, without any further demands upon labour.

A full account of the trial described in this article will appear in the *Journal of Agricultural Science.*

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CORN AND HORN ON THE WILTSHIRE DOWNS

JOHN L. JONES

Colonel Houghton Brown's farm at Lower Pertwood, near Salisbury, Wiltshire, furnishes an excellent example of the potential productivity of thin chalkland.

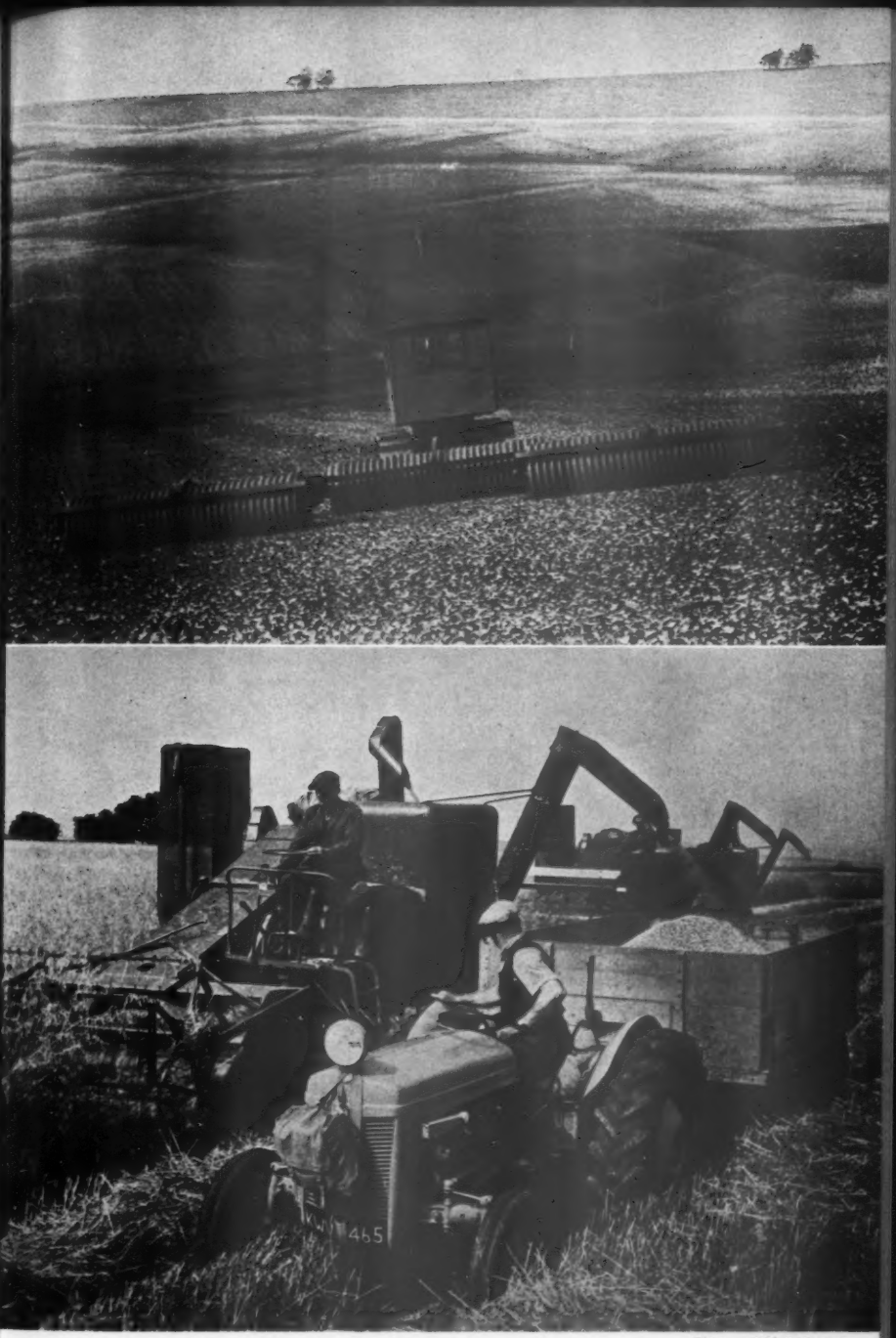
THE seventeen hundred acres of Lower Pertwood Farm sweep from 500 to just under 1,000 feet on the Wiltshire chalk—ancient acres enshrining many thousand years of our farming story. Seventy-five years ago found the grandfather of the present occupier coming into the property in the wake of an outgoing tenant cruelly straitened by the collapse of corn prices. The arable went down to grass, the downs were fenced and Scotch sheep and Irish cattle were used to farm it as a satellite ranch. It remained thus until the end of the First World War, when it had a hundred acres in arable.

Corn and Horn Colonel Jack Houghton Brown, the present occupier, bought the property from his uncle, Jack Stratton, in 1937 and ran it with the hundred plough acres, some store cattle and a folded flock of 500 Suffolk × Scotch Halfbred ewes. During the Second World War the arable rose, under a bailiff, to 300 acres, and as corn increased the stock numbers dwindled, true to the old "Up Corn, Down Horn" tradition. By 1947, cattle and sheep numbers were down considerably; the thin chalk downlands with such symbolic names as Starveal, Poppynap, and Breakheart Bottom, were giving unmistakeable notice to quit corn-growing in the form of mounting disease, shrinking yields and tightening financial margins.

The answer to the problem lay in the reversal of the old slogan into "Up Corn, More Horn", as was recommended to Colonel Houghton Brown by Sir George Stapledon in 1947. The key to corn-growing on the chalk is potash *and* humus, and while the former can be bought in a bag, the latter is the dividend of husbandry alone. The humus-building on Lower Pertwood is done by the ley, the cruciferous crop, beef cattle and sheep, and the careful conservation of straw.

The ley stays down for three years. After heavy winter pounding by the cattle, the ploughed sward is sown to Atle wheat in March, followed by oats or barley and possibly barley again. The field is then taken out for the thorough cleaning which it has been unable to receive during the pressure of cropping. It is bastard fallowed from harvest to midsummer and then, when the risk of the fly has gone, is sown to a cruciferous crop of 1 lb. rape, 3 lb. thousandhead kale and 1 lb. hardy green turnips, which goes down the spout of the combine drill with 3 cwt. of potassic supers per acre into an onion-fine seedbed. The mixture grows fast and dense (Pertwood is in the 40 inch rainfall belt), and by the autumn there are 150 acres of greenstuff, knee-high.

Store Cattle and Sheep To date, the crop has mainly been eaten off by 300 attested Devon and Hereford stores bought in after harvest. These stores go on to leys until just before Christmas and then to the rape and kale with a lie-back field and some oat and barley straw fed on the steep virgin downland. They are not folded but feed the crop in big batches—100 bullocks to 50 acres—until the end of February or early

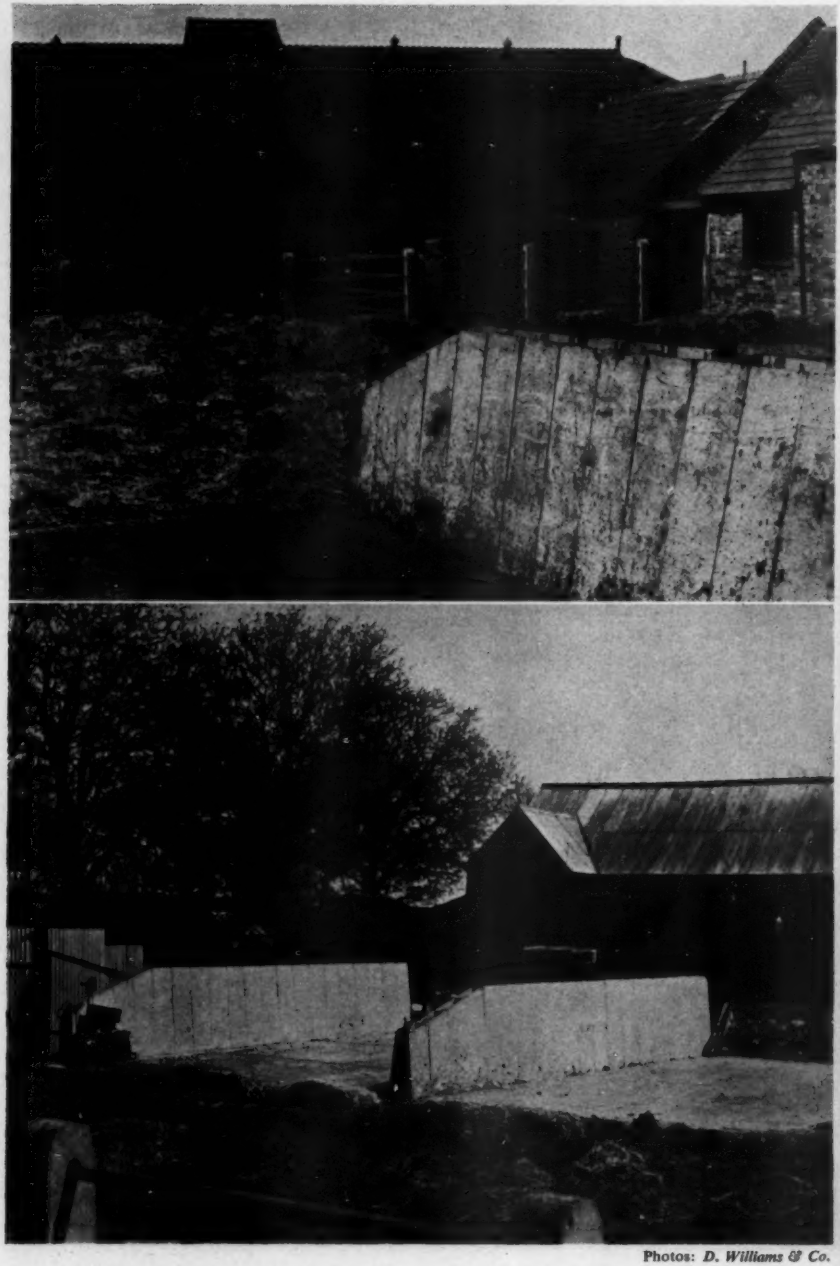


Photos: *John L. Jones*

Lower Pertwood Farm, Salisbury

Rolling with a triple gang on a flinty field.

Eight-feet tanker combines harvesting oats last year.

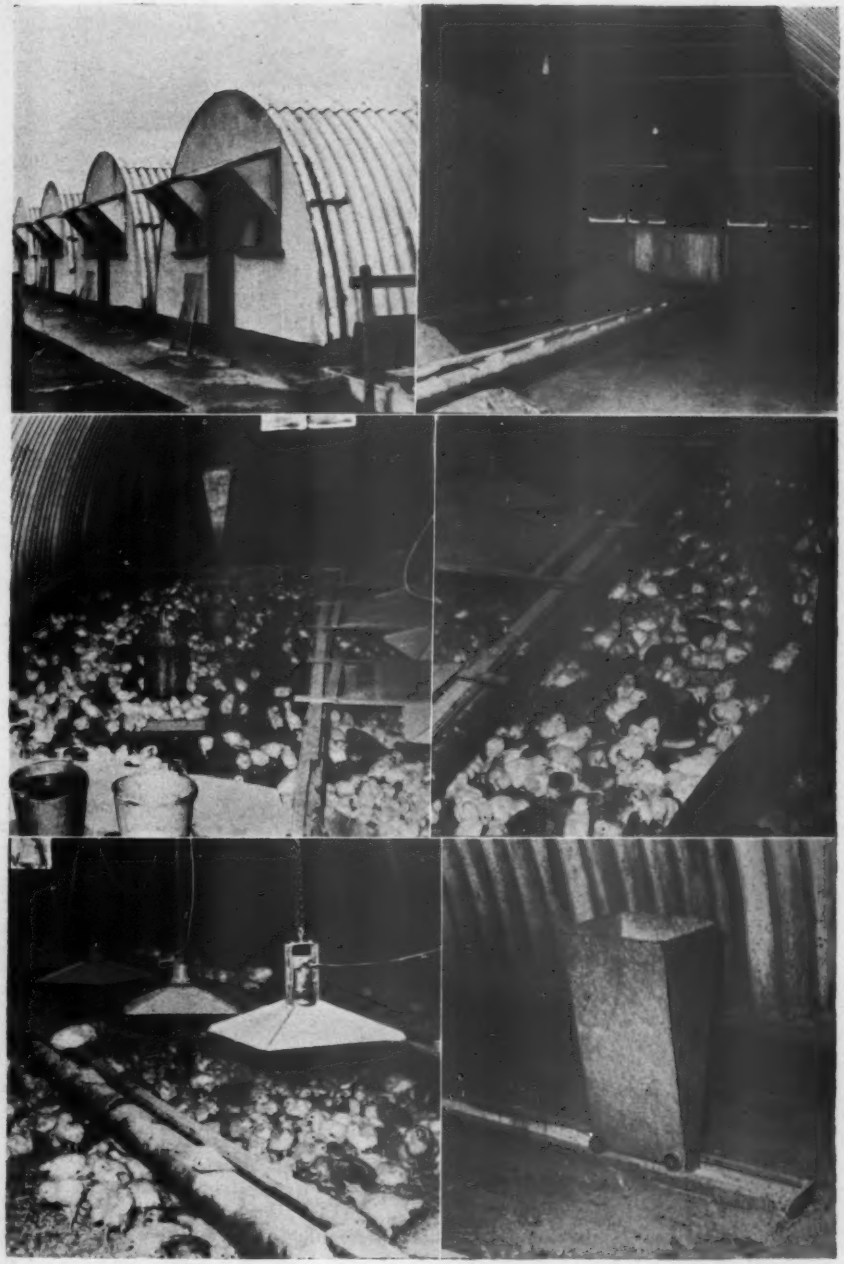


Photos: *D. Williams & Co.*

The old cowshed was converted to form the covered portion of a yard, with a tandem parlour (*right*) at one end.

Open portion of yard. The surface silo is on a concrete floor with ramps at rear.

Broiler Production in Notts (Article on pp. 386-9)



Twelve asbestos huts form the unit. The litter is not renewed between batches but, after removing the hard lumps, is left in two piles to heat up. For the first four days chicks are confined between hot-water pipes and under infra-red lamps: they are then given the run of the floor. A semi-automatic hopper makes for easy feeding.

Photos: *John L. Jones*

Lower Pertwood Farm, Salisbury

Draft Welsh ewes from the Montgomeryshire mountains, with lambs by a Border Leicester ram.

The Hereford suckler herd, with autumn-born calves in April after outwintering.

March. The waste is negligible, and any trampled greenstuff is valuable humus when the land is ploughed for Atle wheat in the spring. The cattle then have one month's straw and silage feeding on the leys and are sold as strong meaty stores from mid-April to June. They show a gross return of about £20 apiece or 10*s*. per beast per week. Apart from the one month on silage, the cattle are essentially scavengers living on by-products—straw, the by-product of corn, and the cruciferous crop, the by-product of the essential cleaning operation at the end of the eight-course rotation.

The cash to buy these cattle—about £15,000 per year—is in effect part of the working capital needed to go on growing good yields of corn on the thin Pertwood chalk. The cattle are in themselves a profitable proposition, but they are more essentially an aspect of corn prosperity—the modern bovine equivalent with a tithe of the labour of the obsolete sheep-folding husbandry of the golden hoof of the downs. To bring down the amount of capital needed in the annual purchase, Colonel Houghton Brown is now breeding and rearing a percentage of stores on the farm from a suckler herd of hardy Montgomeryshire-bred Hereford heifers. To fit this new enterprise into the already streamlined labour set-up of one man to 150 acres without increasing the load, the usual spring beef-calving routine has been reversed. These heifers are being calved down in the autumn, so avoiding the normal yarding of spring-dropped calves in their first winter after weaning. Despite a tough time on last winter's blizzard-swept downs, the herd came through well and most of the calves were in surprisingly good condition. This means that the calves, weaned in July and August and either sold as yearlings or run on to strong stores, will never be housed or yarded. The herd was bred again successfully last November, and by the end of September this year the majority had calved a second time. Last year's calves, now at the yearling stage, are in excellent condition.

To the cattle side of this humus-building enterprise has now been added an interesting sideline of sheep, the pattern of which reflects the recent acquisition of a mountain farm in Montgomeryshire. Over the past three years, a 200-strong flock of Welsh ewes has been built up at Pertwood from the draft ewe culls off the mountain. Instead of going out at worthless prices, they come to the softer contours of Wiltshire downland and are continuing to breed lambs. They live as scavengers on the leys, on the rape residues after the cattle, and on the remaining acres of virgin down. Some of them have already bred three lambs.

The mating is to a Border Leicester tup, and the resultant Halfbred female progeny are being collected into a fine flock which are being bred in the ewe lamb year to a Southdown ram for high quality fat lamb, and for easy lambing. The mountain hoggs also come down to Pertwood for wintering and are fattened out on the summer leys. In the spring the ewe hoggs return to the mountain. The shepherd is mechanized and uses a tractor for the job in between his work on the arable.

Integration of Corn and Stock The correspondence between this increasing stock and corn yields is striking. In 1945, with an arable of 305 acres, the average yields were 8.3 sacks (2 cwt. sacks) to the acre. The stock on the farm was 335 steer equivalents. By 1949, the corn tillage was 505 acres, the stock up to 412 steer equivalents, and the yields up to 13.9 sacks. Last year, the corn accounted for 711 acres and the stock was up to 530 steer equivalents. The average yields from the worst-within-memory 1954 harvest just topped the 10 sacks. The figures for 1955 give an overall average yield of 14 sacks to the acre for 680 acres, with the stock up to 550 steer equivalents. These figures of acreages and yields in-

clude 200 acres of reclaimed chalk sideland, some of it so bestrewn with large flints that it is hard to credit that corn will grow there at all.

The corn-growing, round which the whole economy revolves, is wholly mechanized and shows a gross return of about £35 an acre. The power is provided by three crawler and four light tractors. The tempo of operations is illustrated by the fact that the entire sowing is done with one combine drill, which has reached a maximum of 50 acres sowing a day and averages 38. The cropping, of which last year's is typical, is arranged, as far as possible, to stagger the peak harvest labour load: 50 acres Pioneer barley, 150 acres Blenda oats, 300 acres Freja and Proctor barley, and 200 acres Atle wheat. Oats are not grown from choice, as they are not so amenable to fast mechanical handling, but they are an indispensable rotational safeguard against the menace of "Take-all". The aim is to sell a proportion of oats straight off the field and altogether, including all grains, about 400 tons are sold near harvest time. This year the bulk is being stored for later sale.

Harvesting to date has been done with three 8-foot tanker combines, which this year have been replaced by two diesel, 12-foot harvesters. The corn comes into the wet grain pit of the 4-ton an hour drier in tipping trailers, is pre-cleaned, dried and sacked-off. The in-flow of grain surplus to the drier capacity—it comes in under normal conditions at 6 tons per hour —is stored in bins during the day and dried, cleaned and jogged away to storage at night, when a casual worker supervises the plant. A new grain store with eight silos has a capacity of 400 tons. The corn from these is sold in bulk and leaves the farm in 12-ton tankers.

The collection of the straw baled in the wake of the combines is done the same evening, and three Dutch barns have been erected to store it for winter feeding. Between 400 and 500 tons are fed annually and any surplus to the barn capacity is taken to the mountain farm when the lorry goes to fetch the ewes and lambs or weaned calves from the Welsh Black herd.

Capital locked up in field mechanization is approximately £10,000, or £6 per acre. Annual outlay on fertilizers is about £5,000, or £5 per acre, for the 1,000 acres of ley and corn. The soil of all fields is analysed each year and the soil chemist's recommendations scrupulously obeyed. The biggest deficiency and the one encountered most quickly is potash; potassic supers are indeed the "Open Sesame" to corn yields on the chalk. The minimum nitrogen is used to avoid lodging, which can seriously over-strain the already streamlined labour, time and machine margins of the harvest campaign. The once serious menace of charlock is now controlled by spraying, which is extensive on the corn.

Colonel Houghton Brown is still experimenting with a view to finding the best mixture for winter grazing. The timothy/meadow fescues, as usual, yield superbly, but because the high palatability of the timothy makes it the over-selective target of wintering cattle and sheep, it suffers in consequence. S.22 ryegrass fits well into the economy of stock and crops, since it produces grass early and cuts down the need for hand-feeding at the rush time of spring sowing. S.143 cocksfoot is also grown, and from both these grasses it is hoped in a favourable year to harvest a crop of seed. All the leys are sown under corn.

These achievements of the past eight years at Pertwood provide an impressive example of single-minded initiative in working out and streamlining a corn-growing husbandry for chalk acres. Nor does there seem to be any reason why this formula for building and cashing fertility in successive crops of corn should not remain ecologically sound for an indefinite period.

HYBRID POULTRY

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The rate of genetic improvement in high-producing flocks is getting steadily less under the traditional methods of poultry breeding. There is, therefore, an obvious economic need to try out new ideas where these hold out hopes of increasing the rate of genetic progress. In this article some of the new concepts are discussed in the light of recent results, and others, as yet inadequately tested, are mentioned.

THE high production of modern poultry is the outcome of detailed improvements in a number of interrelated sciences. Nutrition, medicine, husbandry and breeding have played a part in raising output to present-day levels. But it is probably fair to say that future improvements, in the best flocks at any rate, are to be looked for primarily in breeding poultry specifically adapted to the new situation created for them by the other sciences. Tremendous advances, of course, still remain to be made in the majority of flocks before genetic limits become operative. In view of the importance of breeding to future advances, it is worth looking at the breeding method that has been used so successfully in the past and sketching, however uncertainly, the outlines of the new ideas that are now taking shape in the poultry world.

Closed Flock Selection Selection within a closed population based on progeny testing has been used for over thirty years to increase egg production and has become one of the basic tools of the animal breeder. Although it is now widely recognized that for characters of low heritability, like egg production and viability, sib selection leads to more rapid genetic gains, progeny testing of males still has a place in poultry breeding. For traits in which the heritability is high, notably those associated with size (such as egg weight and rate of growth), the individual's own performance should be given greater weight than that of its relations. The degree of attention to be paid to individual and relative depends on the heritability of the character in question, and this varies not only from trait to trait but from flock to flock and within each flock from time to time. Furthermore, no breeder can afford to consider a character in isolation. Consequently he has to use a judicious combination of these methods, flexible enough to meet changing demands and capable of incorporating new ideas. However, under certain conditions—for example, where hybrid vigour operates—closed flock selection is no longer the most effective method.

Hybrid Vigour Increased growth and productiveness occasionally result from the crossing of genetically diverse strains. The genetic basis of this "stimulating effect of hybridity", or heterosis as it is called nowadays, is not at all well known. Briefly, there are two theories. One postulates that increased vigour occurs because favourable hereditary factors, or genes, in each line cover up the deleterious genes in the other when they are crossed. This is probably a true description of the decline following inbreeding and the subsequent rise observed when the inbred lines are combined. But this theory cannot account for the large increases over the level

of the original non-inbred parents sometimes observed in crosses. To explain this, a second theory which regards hybrid vigour as due to the superiority of some heterozygous* genes, or overdominance, has been proposed. It is suspected that this situation occurs for egg number and perhaps viability in some high-producing strains incapable of further response to selection for these traits under a system of closed flock-mating. Attempts to exploit hybrid vigour in poultry have taken a number of forms. In one way or another they are based either on crossing different breeds or on crossing different strains of the same breed with or without prior inbreeding.

Cross-breeding The view that cross-breds are superior to their pure-bred parents is widely held, but experimental evidence does not support so sweeping a claim. There is general agreement that cross-breeding improves early growth rate and that fertility, hatchability, chick viability, age at first egg and egg weight of cross-breds are superior in the majority of cases. When egg production is considered the data are contradictory; the result appears to depend on the level of egg production of the parents used in the cross. Where this is low, crossing has a better chance of raising the level of performance. With regard to adult viability, the verdict is—" not proven ". The claim that broodiness is increased seems fairly well substantiated.

The wide divergence of the results emphasizes the need to test several combinations in order to find those that " nick " well.

Strain Crossing A number of comparative experiments between crosses of different strains of the same breed, cross-breds and pure strains have been reported. Early growth rate of strain crosses is better than in pure-breds but not as good as that of the cross-breds. In the rearing period both types of crosses show higher viability. Differences in adult mortality are not, however, consistent. There is some indication that where strains differing in adult mortality are used, viability of the offspring equalled that of the strain used as female parent. The available results on egg production show an increase for the strain crosses, but the data are insufficient for any firm conclusions. On overall performance, strain crosses appear to be intermediate between cross-breds and pure-breds.

Crossing Inbred Lines The success of the maize breeders in producing high yielding hybrids by combining inbred lines has not failed to influence the poultry industry. Recently, hybrid poultry produced by crossing inbred lines of different breeds, the so-called " incross-breds ", have become popular, so that it would be of interest to know how their performance compares with that of other poultry. As yet no adequate tests have been made in this country but a substantial number of well-designed experiments are under way. In a recent large-scale random sample trial the egg production of incross-breds exceeded that of cross-breds and pure-breds. To what extent this reflected the results of progeny testing of the inbred lines rather than any benefits of prior inbreeding is debatable. Viability during the laying period was unaffected by the system of breeding.

For a number of reasons, all concerned with the fundamental biological differences between plant and animal material, crossing inbred lines is a much more difficult and costly proposition in poultry than it is in maize. The development and testing of an adequate number of inbred lines

* In the body cells of an individual the genes occur in pairs, one member from the sire and the other from the dam. If the two members of a particular pair are alike, the individual is said to be homozygous in respect of this pair; if they are unlike, heterozygous.

requires facilities available only to the very large breeder or to experimental stations, preferably working co-operatively, as under the Regional Poultry Testing projects in the United States. Consequently, breeders have turned their attention to the search for less cumbersome means of exploiting hybrid vigour in poultry. Crossing breeds without prior inbreeding has already been mentioned. This system suffers from the practical disadvantage among others of requiring the maintenance of two breeds to provide the birds for crossing in each generation. In a method of breeding known as criss-crossing, the cross-bred pullets are mated with males of one of the pure breeds. In the next generation the males of the other breed are used, and so on. After a few generations the population settles down to an average genotype corresponding to two-thirds of the sire's breed and one-third of that of the maternal grandsire. Australian results indicate consistent increases in egg production of the criss-crosses over the pure-breds. There appears to be no definite increase over the production of the single crosses, but at least there has been no decline and it seems that criss-crossing does not lead to any loss of heterosis.

New Breeding Methods Two new breeding methods, originally suggested on theoretical grounds for the improvement of grain yield in maize as superior to crossing inbred lines if overdominance is important, are at present being tested on poultry. The first of these, *recurrent selection for nicking*, involves selecting males and females from an outbred population on the basis of the performance of their offspring with an inbred tester strain. The proven parents are mated together to continue the strain and their offspring are in turn mated to the tester strain for the production of a testing generation. Sufficient numbers have to be retained each generation to keep inbreeding at a minimum. Progeny testing of the outbred strain is continued until there is no difference between members of the outbred strain, as judged on the basis of their offspring with the tester stock. Under this scheme two stocks have to be maintained throughout. It is essential to continue the inbred strain intact, as the whole objective of the operation is to increase those gene combinations in the outbred stock that combine with genes in the tester stock for maximum heterosis. Commercial birds are produced by crossing tester males to females of the outbred stock.

The second method, *reciprocal recurrent selection*, holding out rather greater hopes for the poultry breeder, is also based on progeny testing but uses two different outbred populations. Its advantages over recurrent selection are that the expense and uncertainty associated with an inbred tester are avoided, the theoretical limits of improvement are higher, because there is the possibility of introducing new genes from both sides of the cross, and saleable chicks are produced right from the start. Against these advantages must be reckoned the reduced accuracy of identifying superior genotypes combined with slower rates of improvement and the extra labour involved in pedigreeing both sides of the cross.

A combination of these two methods might turn out to be more effective than either alone. One strain would be an outbred tester, but the other would consist of a number of inbred lines. Selection between inbred lines can then be made every generation on the basis of their performance with the outbred strain.

The disadvantage of these methods lies in the fact that at least two years are required for reproducing one generation of the desired strain—one for testing and another one for multiplication. As breeders are interested in the annual rate of improvement rather than the improvement per generation,

means must be sought of reducing the length of the generation. One way of doing this would be to telescope the testing and multiplication generations into the same year. Instead of breeding only from progeny-tested parents, all birds tested in combination could be bred from, only the offspring of birds proved by the performance of their test-cross progeny being retained for future breeding. Here the drawback is the extra breeding pens needed for each strain, and it is open to discussion whether it would not be better to use the increased facilities for testing more birds.

There is no doubt that hybrid poultry are of value to the poultry industry and that they will be increasingly so in future, but it should be borne in mind that some of the sweeping claims made for them are of doubtful value. Sound experimentation is worth a lot more than high-powered publicity. Meanwhile we should remember that some progress can still be made in many pure-bred poultry stocks by applying conventional systems of selection, based on mass and family selection and on progeny testing. Any advances made by this method can then be utilized if the stock is subsequently bred by any of the new techniques based on heterosis.

BROILER PRODUCTION IN NOTTINGHAMSHIRE

A. H. Home, N.D.P.

East Midland Province, National Agricultural Advisory Service

Describing the feeding and management of broilers at the Newark plant of Messrs. N. W. Hempsall.

During the past two years or so broiler production in Nottinghamshire has developed to a pattern of housing and management influenced by the establishment of a poultry packing plant and the development of the broiler plant by N. W. Hempsall Ltd., Walesby, near Newark. This particular plant consists of twelve separate 50 feet × 19 feet × 10 feet high asbestos Nissen hut type buildings. The asbestos erection is set on 2 feet high concrete walls and each end of the house is filled in by concrete blocks, into which are fitted two louvre-type windows at each end.

After putting through a few batches of broilers, it was found that condensation formed on the walls of the asbestos building, and in the hot weather it was difficult to keep the inside temperature of the building within comfortable limits. The buildings have now been underdrawn to a height of 7 feet 6 inches, which Mr. Hempsall thinks could with advantage be lowered, possibly to a height of 6 feet 6 inches or 7 feet.

The remainder of the walls have been covered with fibre board almost down to the height of the concrete wall. Since complete insulation was carried out, there has been a marked saving in fuel—coal and electricity.

The whole plant of twelve broiler houses is heated from a central, automatically coal-stoked boiler which, during the winter of 1953-54 (when the buildings were uninsulated), consumed 3-4 tons of coal per week. Two 4-inch hot-water pipes set 4 feet apart and 12 inches above the concrete floor run the length of the building. The house temperature is maintained

at 60-65°F. for the first few weeks of rearing by thermostats which control the central heating individually to each building, and also a 12-inch extractor fan placed at one end of the building. In addition to the extractor fan, the louvre windows are opened and closed to control the ventilation.

Feeding A simple but very effective watering system has been installed. This consists of a 1 inch × 1 inch V-shaped metal trough running the whole length of one side of the building. A continuous water flow is maintained by a drip feed at one end and draining away at the far end. The water is maintained at a depth of ¼ inch. The height of the water trough can be varied according to the age of the chicks. To help resetting of the trough, an ingeniously simple, flexible joint connects each 10 foot length of trough. This trough runs parallel to the concrete floor of the building, which was in fact laid down with a fall of 1 inch in 10.

Mr. Hempsall has an inventive kind of mind and has devised a simple automatic feeding system which is today used in other broiler plants up and down the country. This feeder consists of a 42-foot long metal trough 7 inches wide, with a 1¼ inch lip on each side. A V-shaped food hopper holding 56 lb. of food stands on four rubber wheels spaced so that they run on the lips of the feed trough. The operation of this semi-automatic feeder consists of the attendant filling the hopper once or twice a day, according to the age of the chickens, and moving the hopper along the whole length of the trough, leaving behind a 2-inch depth of mash. Two such hoppers and troughs are standard in each house.

Always on the look-out how to cut costs of production, Mr. Hempsall has recently installed a wooden food bin, built on legs and placed just inside the door of each house. Each of these bins holds 15 cwt. of feedingstuffs—enough to feed 1,000 chicks for one week at 11 weeks of age. The miller who supplies the broiler feed fills the bins direct from the lorry, so saving handling time and the cost of bags. This economy means a saving of 30-40*s.* per ton of food, or £8-10 on each batch of 1,000 broilers sold at 11 weeks old.

Every building is provided with three 15-watt lamps, which are on continuously. The dim light provided during the hours of darkness allows the chicks to rest and, at the same time, prevents the tendency to over-crowding and maybe smothering if the chicks were kept in total darkness during the night.

A proprietary broiler ration is used, which contains, in addition to the normal chick ration ingredients, coccidiostatic in the form of nitrofurazone, organic arsenic and procaine benzyl penicillin G.

It was observed that when the ration used was of the normal coarseness of grinding, outbreaks of coccidiosis occurred. This was thought to be due to the possibility of uneven distribution of nitrofurazone in the feed, so the ration was supplied in an extremely fine texture. This certainly overcame the coccidiosis difficulty, but with it came another problem in the form of serious malformation of the beaks due to the food sticking in the corners of the mouth and beaks generally. To overcome this, half pellets and half mash has recently been introduced, but it is too early yet to say anything about this method of feeding.

Mr. Hempsall thinks it would be too risky to feed all pellets because of the greater tendency to cannibalism; he is considering debeaking the birds at day-old, or maybe at a week. Flint grit is fed *ad lib.* from day-old onwards. The cost of the whole plant and equipment to carry 1,000 per house to 11-12 weeks of age is £5,000, or 8*s.* 4*d.* per chicken.

Management When the plant was first started, sawdust and wood chippings were put down to a depth of 5-6 inches. Five batches have gone through the plant to date and no new litter has been added since the original application. When each batch of broilers has been cleared from the house, the top 2 inches or so (the hard lumps) are taken off and the remainder put into two heaps, where it remains for six days to heat up.

In spite of taking out about a third of the litter, the depth, after being used by chicks for another 11-12 weeks, is restored to its original 6 inches or so, which means that after one year of continuous use the litter must now consist of something like 100 per cent chick droppings.

This continuous use of the same litter does not appear to have had any ill-effects; on the contrary, it was observed that the growth rate was better in the later batches than that in the initial lot, which had the benefit of new, clean litter. Mr. Hempsall sees no reason why, if the litter can be kept dry, he should not continue his system of litter management. To clean out all litter and replace with new, he says, would (with labour and material) cost an additional £3-4 per batch of broilers.

Every week, 1,400 day-olds are put into a house and at 8-9 weeks old 400 are sold as *poussins*, leaving 1,000 chicks to be carried on to 11 weeks. During the summer months only 850 chicks have been carried on to marketing stage, because of difficulty of keeping down the room temperature and consequent tendencies to cannibalism.

The chicks are placed on the floor in four groups between the hot-water pipes, with additional heat supplied by four 700-watt infra-red dull-emitter lamps. Aluminium surrounds (which are very easily cleaned and reflect heat) enclose the chicks for the first four days, when all the chicks are given the freedom of the whole of the floor space. To conserve the heat from the electric heaters and the hot-water pipes, trays supporting bags of hay are placed on the pipes above the chicks.

Small metal water fountains and wooden feed troughs are provided for the first four days. After that, the laid-on water and automatic feeders come into use.

This broiler plant, where one age group is confined to the same house, producing a thousand 11-weeks-old broilers and 400 *poussins* per week, with automatic watering, feeding and heating, lends itself to a management system with the minimum of labour.

The total labour employed consists of one girl working six hours a day, and two men who work four hours on one day a week to take out the litter from the empty broiler house.

Where the same litter has been used continuously, it has been found that an excessive amount of ammonia fumes is given off, causing some of the chicks to suffer from conjunctivitis for the first few days. After a week or so the chicks do not appear to be affected. This has led Mr. Hempsall to introduce supplementary rearing in tier brooders for the first seven days. This means that with the existing twelve broiler houses he can carry the chicks to 12 weeks of age, a saving in housing costs where an alternative brooding plant already exists on the premises. The first impressions of using supplementary rearing are such that Mr. Hempsall intends to adopt this system permanently for broiler production.

Consideration is also being given to the desirability of using mixed sexes instead of cocks only, as is the normal practice in this country. He believes the hatcheryman could supply the mixed sexes at a minimum price of £5 per hundred, as against £8-9 per hundred for cockerel chicks produced during

the time when the normal hatching season is not operating. This would show a comparative saving of about 2*d*. per lb. live weight, which would probably more than counteract the benefits of rearing one hundred per cent cockerels.

Trials are to be carried out using a cheaper feed during the later stages of rearing. The possibilities of bulk deliveries of feedingstuffs are to be explored, but Mr. Hempsall doubts whether he can improve on his present system, because he realizes that there are possibly too few plants in this country which could avail themselves of such a service and thus it would not warrant the high equipment costs which the miller would have to bear.

All the broilers from this plant are marketed through a nearby poultry packing station where all carcasses are packed and graded. The output of Mr. Hempsall's plant shows 85 per cent Select and Grade A.

In addition to this broiler plant, five others have been established on general farms, which follow a similar pattern of housing and management, but with a smaller output of between 4,000 and 8,000 broilers per year on each farm. In a few of these cases the local packing station has arranged to erect the buildings, supply the chicks and food, and market the finished product. Such a plan, combined with lower production costs and retail prices, could quickly increase table chicken production in this country.

Since this article was written, it has been established that supplementary brooding for one week in tier brooders has reduced the initial losses of chicks, and also the introduction of 50 per cent chick pellets and 50 per cent mash has shown a better food conversion. This changed method of feeding has meant a greater tendency to feather picking and cannibalism, but this was quite simply counteracted by painting the hut windows blue.

GREEN KETTLES

C. R. H. BENNETT

Brackenborough Hall, Louth, Lincs

Better living conditions for farm workers will keep the men and their families on the land. With the help of Government grants, Mr. Bennett is now supplying his eight farm cottages with electricity and good water.

OWNERS more illustrious and efficient than myself have already put their houses in order, and this article is in no way an attempt to place me in their ranks. In fact, it is almost a confession of failure to foresee the inevitable—which was forced upon me by an incident which can be called "The Inside Story of the Green Kettles". Brackenborough Hall Farm, which I took over from my father in 1948, comprises the mansion, eight cottages and about 460 acres of arable and grass. The soil is mainly medium loam with deposits of boulder clay. The Park and the old and new leys account for 170 acres; about 230 acres are corn and the remainder roots. This, together with 80 head of beef cattle and about 400 sheep, requires a labour force of at least 9 regular men, and means that every cottage must be occupied. Since 1907 there have been no major improvements to the cottages, which are built of brick with slate roofs. They may be over eighty years old, but they are all structurally sound.

GREEN KETTLES

My father put in an electric lighting plant for the Hall in 1923, but in 1952 it became clear that repairs to the paraffin engine and batteries were no longer worth while. The local Electricity Board gave no hope of a mains supply being made available for some years, so I had to install a new private plant. A few months later, however, the Board informed me that it was able to erect overhead lines which would bring electricity to my property.

In 1934 my father sank a deep bore and supplied the Hall and farm cottages near it with good water, but two pairs of cottages, each about half a mile from the Hall and half a mile apart, have relied on water from shallow wells. Late in 1954 the occupiers of the cottages near the entrance to the Park complained that the water from the well tasted unpleasant and was turning the inside of their kettles green!

Brackenborough Hall Farm is 1½ miles east and 2 miles west of the nearest water mains. There is no hope of a main ever being laid nearer the property. The surveyor of the Louth Rural District Council soon confirmed that the well water was not fit for human consumption and suggested that I laid water to the cottages from my own bore with the help of the grant available through the County A.E.C. When I told him that mains electricity would shortly be available, he suggested I should consider carrying out a programme of improvements to all the cottages, taking advantage of the grants under the Housing Act.

With the surveyor's help, plans for each cottage were prepared and approved, and building work is expected to begin shortly. In the meantime, the houses have been wired for electricity, and the supply was switched on a few weeks ago. Unfortunately, the water from the bore proved to be below standard, and the necessary steps have been taken to seal the bore against outside pollution. Each cottage will now be provided with good water, bathroom, W.C., and other amenities.

Even with the help of the grant, the improvement of eight cottages is an expensive undertaking, and as an owner I can see no direct financial return for it. My property may be worth more, but I am not thinking of selling. As an occupier, however, I can gain immense benefits, although these may not have an obvious monetary value. First, with good modernized cottages, I can compete for the best type of worker and have a fair chance of keeping him. Secondly, I need not fear his leaving for the sake of a job with a better house. Last, and by no means least, a contented housewife generally means a contented and better worker.

There is no doubt that the problem of finding and keeping good agricultural workers is becoming more acute. I am aware that I have undertaken the improvements to my cottages only just in time to avoid really serious labour shortages on my farm.

CLOVER SEED WEEVILS AND SEED YIELD

T. J. LEGOWSKI, B.A.

National Agricultural Advisory Service, Eastern Province

East Anglian investigation has shown that DDT sprayed at the right time can control Clover Seed weevils effectively and so safeguard seed production.

THE production of clover seed is an important and often a very profitable sideline for the farmer, but like many similar enterprises it is full of hazards. Unfavourable weather may result in a total loss, and even in a good year yields may fall far short of what was expected. There may be many reasons for this, but one of the commonest causes of loss is the damage done by insect pests, of which the Clover Seed weevils (species of *Apion*) are usually thought to be the most important. They are small black weevils—about one-eighth of an inch long—characterized by a long thin snout. They can, as a rule, easily be found on the clover during the summer. Like many insect pests, they pass the winter in sheltered places such as hedges, grass banks and stack bottoms. With the coming of warmer weather at the end of April and in May, they move into the adjoining fields in search of clover. They feed on the leaves, the damage appearing as small holes and slits, though it is unlikely except in more severe cases that it affects the growth and yield. After mating, the weevils lay their eggs in the flower-heads while these are still *green*.

In about ten days the eggs hatch into small maggots or larvae which feed on the developing seed. Growers are familiar with the small curved whitish maggots, legless and with a brown head, which are frequently found inside maturing flower-heads. The larvae feed for about three to four weeks and eventually change into pupae and then, after a few days, into the adult weevils. A second generation can sometimes be produced until, with the arrival of autumn, the weevils wander again in search of a suitable shelter for overwintering till the following spring. Each larva can destroy several seeds and, as it is not unusual to find several larvae inside one flower-head, the loss of seed can be serious.

Investigation into Control DDT dust or spray has been shown to be very effective against the weevils, and abroad some striking increases in yield have been reported as a result of its use. In this country, although spraying or dusting has become a routine on many farms, there was little experimental evidence about the value of these control measures. In view of this, we carried out investigations to try to answer the following three questions:

1. Are the control measures effective?
2. How does one application of DDT compare with two?
3. What is the effect on yield?

The work was carried out over three years. In 1952, preliminary observations were made in Hertfordshire on six fields sprayed with DDT three to five weeks after the first cut and on seven fields which were not sprayed. In 1953, investigations were carried out on nine fields of broad red clover, all on one farm in Cambridgeshire, which were treated as follows: three were sprayed

once, three were sprayed twice, and three were not sprayed at all. The first spray was applied 1-2 weeks after the first cut, and the second 2-3 weeks later. In 1954, observations were made on nearly twenty fields of broad red clover scattered throughout the eastern counties. These fields were sprayed once and in such a way that an untreated strip 40-100 feet wide was left at the side of each field so that a comparison could be made between the treated and the untreated portions. This layout was considered satisfactory, since observations had shown that, except on very large fields, the weevil population was reasonably uniform over the field as a whole. The results were assessed by the following methods:

1. Sweeping the crop with a net and comparing the numbers of weevils caught;
2. Taking samples of flower-heads and comparing the numbers of larvae found inside the heads;
3. Taking samples of flower-heads and comparing the weights of seed;
4. Comparing the final yields obtained by the farmers.

Are the Control Measures Effective? DDT spray or dust applied at the right time—that is, not later than about three weeks after the first cut—killed most of the weevils and greatly reduced the larval infestation. On the average, over 80 per cent of weevils were killed by a single application of DDT and, *when the timing of the application was correct*, there was a similar reduction in the numbers of larvae in the flower-heads. On one or two fields, although there was a good kill of adults, there were many larvae in the flower-heads because the treatment had been applied too late—that is, after the eggs had already been laid. The treatment should be applied preferably not later than about two weeks after the first cut, certainly before the buds are formed and before the weevils can lay their eggs.

One Application of DDT or Two? Direct comparison between one and two sprays was made only in 1953. Single spraying then reduced the adults by 75 per cent and the larvae by 80 per cent. The corresponding reductions for two sprays were 90 per cent and 95 per cent. The improved control by the second spray gave no significant increase in yield. In the 1954 investigations, when all fields were treated only once, there was an average reduction of 90 per cent in the numbers of adults and larvae—results almost as good as those obtained with two sprays in the previous year. Admittedly, the infestations were lighter in 1954 than in 1953, and it is possible that with heavy infestations two sprays might be preferable. Generally speaking, however, a single application of DDT should be sufficient to ensure a satisfactory control.

Effect on Yield In 1952, the average yield of seed per acre was 1.5 cwt. on the untreated fields and 3.7 cwt. on the treated ones. The average yield from the samples was almost twice as high on the treated as on the untreated fields. In 1953, the mean yields per acre were 0.7, 1.6 and 1.7 cwt. for no spray, one spray and two sprays respectively; the average yields from samples were about three times higher on the treated than on the untreated fields. Although the data were so limited, the differences between the treated and the untreated fields were sufficiently large to be significant. The differences between one and two sprays were not significant. In 1954, when owing to the very wet weather only one or two fields were harvested, the yield of seed had to be assessed entirely by sampling of flower-heads. There was a highly significant average yield increase of 17 per cent on the treated areas.

Conclusions and Recommendations There is thus a fair amount of evidence to show that during the last three years at any rate, spraying of clover with DDT in East Anglia has given a good control of weevils and appreciable increases in yield of seed. This not only agrees with observations made by other workers, but was also the general opinion among growers in the important clover seed producing areas of East Anglia. It is worth remembering that with the present price of clover seed, about 5 per cent increase in yield will be sufficient to repay the cost of insecticide (about 15*s.* per acre). The spraying can be done at low or high volume, using about 1 lb. of actual DDT per acre. This represents 5 pints of 15 per cent emulsion, 4 pints of 20 per cent emulsion, or 3 pints of 25 per cent emulsion per acre. It should be applied not later than about 2-3 weeks after the first cut. On a late-flowering clover, the timing of treatment will be different. As the crop is not normally cut for hay or silage, it is usually too far advanced by the time the treatment should be applied. Where a light cut is taken or the crop is grazed, the treatment should be applied immediately afterwards: otherwise spraying at perhaps a higher rate before many buds have been formed, but not before the first week of May, appears to be the only alternative.

The question arises whether to spray every field of clover kept for seed every year as a matter of routine. There is, for example, some evidence to suggest that Clover Seed weevils are of less importance in some districts and also that they are less numerous and less likely to affect the yield seriously in some years than in others. It is almost certain that in East Anglia they were much more troublesome in 1952 and probably in 1953 than in 1954. Again, some fields are more prone to attacks than others. For example, small fields surrounded by hedges and thickets are likely to suffer most, especially if adjoining fields had previously been cropped with clover. All these factors make general advice difficult. Obviously more work is needed, and in the meantime growers wishing to obtain more specific advice may like to get in touch with their N.A.A.S. advisers. In general, however, the indications are that spraying in areas where Clover Seed weevils are known to be a problem is likely more often than not to repay itself amply.

Finally, a word about danger to bees. It is a common knowledge that pollination by bees is an important factor in seed production. Every effort must therefore be made to prevent any risk to bees. Fortunately, if the insecticide is applied at the proper time—that is, well before the flower-heads are formed—there can be no danger.

Some Articles of Outstanding Interest

● **NEXT MONTH** ●

Dairying in India and Pakistan	*by* A. W. MARSDEN
Trickle Irrigation and Water Requirement	*by* G. F. SHEARD
Sheep Dog Trials	*by* SYDNEY MOORHOUSE
Wool Marketing	*by* A. T. BROOKE
Egg Production and Flash Lighting	*by* E. W. NIGHTALL

Place an order with your newsagent and make *sure* of your copy.

THE DAIRY SHOW, 1955

HERE in London, the season of mists is upon us. But elsewhere lingers still the mellow fruitfulness of autumn, and some of it was brought to the capital last month by the Dairy Show at Olympia which, as always, provided a strong link between the townsman and the countryman. On the day before the show opened on October 25, 36,000 advance tickets had already been sold.

At this year's show, the 69th in a series begun in 1876, nearly 350 cattle came forward from the original entry of 795 animals. This must be a record, but the show was also notable for the good turnout of Ayrshires, more than 90 of them, and the absence of a Friesian team in the stock section contest for the Bledisloe Trophy. The breed did not compete, in protest against the new scoring system introduced last year, and the trophy was won by the Ayrshire team, with the Jersey team as reserve. The Buckhurst Cup, awarded on points for inspection, milk and fat production over three successive lactations in relation to live weight, was taken by an eleven-year-old Jersey "Moles Postman's Glaucena". The thirteen South Devons, appropriately enough lodged in the cattle lines next to the six Dexters, provided the heaviest beast of the show, with "Sandwell Precious", weighing over 15 cwt. The Supreme Championship went to a British Friesian "Fence Dewdrop", owned by Mr. A. M. Jones of Court Calmore, Montgomeryshire.

In the small livestock section, over 2,500 head of poultry was shown and, in the produce section, the exhibits of bacon, butter, cheese, fruit and vegetables were of a high standard. In the dried milk class, introduced this year, the Dominions vied with the home country for the honours. A new feature of the show were the daily talks, film shows and demonstrations of bacon production, butter- and cheese-making, table poultry preparation, electricity in dairying, and other subjects.

In dairying, as in most branches of farming, increased mechanization means increased productivity. This year, heavy dairy produce machinery was included in the show and new inventions outnumbered those shown in 1954. In an impressive display of modern equipment, two such innovations, of interest to the egg trade, attracted much attention. The first was a hand-operated bulk loader for transferring filled Keyes trays on to the feed conveyor of an auto-strip candling and grading unit. It was claimed that the loader could deal with 18-20 cases of eggs per hour and that output from the grader increased, as a result, by 25 per cent.

Another firm demonstrated a stacker unit capable of holding six Keyes trays of eggs which were automatically loaded on to the feed conveyor by a row of six rubber cups. The cups lift the eggs by suction and place them gently on the feed conveyors to the candling position. The manufacturers claim that the chances of damage from hair cracks during loading are eliminated. In prototype form, a double unit of this kind graded up to thirty cases of eggs per hour with a staff of six.

Each year, the show demonstrates the progress made by the dairy industry. A visit to Olympia this year could not have been anything other than of practical value to the man who lives by dairy produce. In addition, as the Marquess of Abergavenny, President of the British Dairy Farmers' Association, pointed out, it affords the public a chance of seeing much that is interesting and a chance of understanding the problems of producing, processing and distributing much of the nation's food.

FARMING AFFAIRS

Moroccan Harvest Living in the country, here in Morocco, one might easily be back in Bible times. Long-eared wheat, oats, millet, chickpeas—all are grown and harvested in the same way as for centuries past. In French Morocco the natives are learning to use modern machinery and modern methods of farming, but round the small villages the old ways prevail.

In autumn the wooden ploughs, pulled by a pair of bullocks and sometimes horses or a mixed team, barely scratch the ground. Behind, a man scatters the grain, carried in the hood of his *djellaba*, the native cloak of coarse woven wool. Erosion is outside his ken; he just ploughs a few furrows deeper than the others up and down across the field, so that the excess water should run off. When a gulley starts eating into his field he merely shrugs his shoulders and says, "It is the will of Allah!" No fences or hedges divide the fields, only narrow strips of soil which, after a long time, become banks on which grow wild blue irises, prickles and weeds.

In June and July, the whole village turns out to help with the harvest. When the crop is too large for one family alone to handle, they hire other Moors who own no land or some of the poor town Moors. No money passes between them; all the work is paid for in kind. To the man who did the ploughing goes one-quarter of the crop, and his wife is allowed to glean. The harvest is cut by hand, maybe by one or two men or a line of four or five, all using sickles and cutting the wheat three-quarters of the way down the stalks.

Behind the men walk several women in their white and red striped towels and large straw hats, who spend the mornings picking up all the fallen ears. In the afternoon, these women sit in circles of three, with sheaves piled around them, and beat out the grain with heavy pieces of olive wood, into which crude teeth have been cut along one side.

These women work long hours, from about 7 a.m. till sunset, with two hours off at midday, when they eat and sleep under a crude shelter rigged up in the field to shield them from the blazing sun. Each evening, the owner comes along and divides the amount of grain equally between himself and the women. Thus each woman earns according to the amount of work she has done during the day. This is the only way that these natives, who are not outstanding for their honesty, will work well. If paid a regular wage, they work as slowly as possible, and I have no doubt they also manage to slip a little extra grain into the many folds of cloth round their waists. We often used to have to search them in the evening when we noticed them to be extra plump round the middle! They never minded. At the present price of wheat, these women earn the equivalent of about 10*s.* a day, but it depends on the amount of grain they have beaten out of course.

Horses and donkeys carry the sheaves and the grain already beaten out off to the village. Then the cattle are turned into the field. Most fields are under cultivation nowadays, and as the natives rarely buy extra feed for their animals, the poor beasts are left out to eat what they can until the rains come, which may not be until late September or October.

With each family's wheat stacked neatly around a square on the outskirts of the cacti-hedged village, the men prepare the threshing floor. Cow dung mixed with water is spread over the levelled ground with a bunch of dried twigs, so that all the cracks are filled and the ground made smooth and hard.

Horses and cattle, generally harnessed three abreast, are then driven round and round over the ears. Smaller owners continue to use women beaters. The straw is made into a neat stack and used later for thatching the native mud huts or as feed for their animals. Towards the end of the harvest, the villages are surrounded by neat, golden "bee-hives", some of them protected by thorn hedges.

When all the grain has been trodden out of the ears, the men toss it into the air with three-pronged forks or spades of wood, while the women pour the cleaned grain into baskets and bags of woven palmetto fibre. There is nearly always a strong wind blowing, so the winnowing is easily done. The chaff is used for mixing into the mud bricks with which the walls of the huts are built.

Thursday and Sunday are the local market days, when the horses and donkeys are driven into Tangier, carrying the grain which is sold in large open baskets. The Moors use a special measure for grain, the *toumini*, which is shaped like a small wooden keg with one end open, and holds roughly 13 pints (6½ Kg.). Wheat is now being sold at the equivalent of 4*s*. 6*d*. per *toumini*, but the price varies with the season.

No sooner is the wheat harvest over, than the millet is ripe and the work begins again in much the same way. The Moors around Tangier cultivate about as much millet as wheat. This is also used for bread and for feeding to their chickens.

Despite long hours in the burning sun with perhaps a violent Sirocco blowing and no shade anywhere, young and old enjoy the harvest thoroughly, singing and joking among themselves, though the sexes keep apart. The toughest time is when their annual religious fast of Ramadan, lasting a month, falls during the harvest. Then they must go, without food and water, from daylight till after sunset, some seventeen hours, and the women have to spend part of the night preparing the meals while their men get what sleep they can.

M. Bull,
Tangier

The Mechanic on the Farm: 19. Workshop Drawings The farm mechanic who wants to get special pieces of equipment made by a blacksmith or engineer, or wishes to make equipment designed by other people, will need to have a knowledge of the simpler forms of machine drawing and constructor's plans. But he can easily acquire this with a little practice. Blue-prints are rarely provided for an implement or part which is to be constructed in an engineer's shop, and there will be no need to take copies; the original sketch can be used. Indeed, the making of pieces of machinery in the farm workshop will often be done not to true blue-prints but to black and white printed designs which have been published in periodicals or prepared in large numbers by advisory institutions.

There are two main types of drawings—detail drawings which show views of individual components, and assembly drawings which indicate how the components are to be fitted together to make the complete machine.

A mechanical drawing is usually set out as a plan and one or two elevations, in what is called orthographic projection, but in some instances it is possible to avoid making separate plans and elevations by showing the object in two dimensions, using a process called isometric projection. This enables more than one view to be seen at a time, but the drawing is not in perspective. All lines are drawn to their full lengths to scale and can be marked with the appropriate dimension, just as in an ordinary drawing. But because of the lack of perspective, the representation of the object is not natural.

A set of compasses with interchangeable pencil, ink nib, and divider points will be needed if drawings are to be made in the farm workshop; also a set-square, T-square, and a drawing board of about 20 inches × 30 inches. Some wooden supports to prop up the board at a convenient angle on one of the work benches will serve instead of a draughtman's table. A ruler, marked not only in inches but with some of the more common scales of proportion, is almost essential for making drawings and reading them.

The farm mechanic will leave most of his drawings as pencil sketches. For any that have to be inked in, he should use Indian ink. An ordinary, fine, hard writing pen nib serves for freehand lines, but for ruling straight lines against a ruler and for making circles with a compass it is best to use a double-bladed pen, which is filled by using the quill provided in the underside of the cork in most makes of Indian ink. It may also be as well to buy a small erasing knife to take out the mistakes that are almost bound to occur.

Although the dimensions should be clearly marked on the drawing before it is taken to a constructor, all the lines should be drawn to their correct lengths, and the scale should be plainly shown at the bottom of the drawing. The workman will often need to know dimensions not marked directly as figures on the drawing, and he will want to be able to measure with a scale.

Large drawings are not easy to store in the workshop without creasing, becoming dirty or fading. A box or drawer where they can be laid flat, or with only a few folds, is desirable, but if neither is available it is best to roll and tie the drawings.

H. J. Hine

Farm and Forest:
8. Treating Old Woodlands (2)

After a broadleaved woodland has been felled, the land gradually reverts to forest, and in most cases this natural development passes through three phases. The first is when the woody regrowth is not more than about 6-7 feet high and "gappy". By cutting out the worthless stems, it is sometimes possible to discover enough young trees of valuable species to give promise of a fully stocked forest without any planting: more commonly, however, the valuable species are scattered irregularly, and where they are absent it is necessary to clear the ground and replant. But these new areas will be tedious to maintain if they cover less than about a square chain. If there are no potentially valuable stems at all in the young regrowth, the most straightforward course is to clear and replant the whole area. The cost naturally varies according to the treatment: it may be as little as £3 per acre for freeing enough valuable young trees, or up to £15 per acre if it is necessary to clear and burn the whole site.

The second stage is when the branches of neighbouring trees become big enough to meet and so form a more or less impenetrable thicket. This phase may persist for something like ten years, during which any forest operations would be both difficult and expensive. However, as the trees grow the lower branches and undergrowth are killed off due to lack of light and working conditions become much easier.

The third and last stage in the normal growth of a wood is when the trees have become appreciably higher and it is possible to walk underneath a canopy of the higher branches (although all too often woods which have reached this state with little or no previous attention contain a lot of poor quality stems). The first step here is undoubtedly to look carefully at the individual trees making up the wood to decide whether any of them are worth keeping. It may be that a valuable wood can be created by the proper tending and thinning, but usually there are too few trees of timber species present to allow this. Two courses are open—either to clear the wood and replant on bare ground, or to thin pretty heavily, leaving enough trees to

cast a light shade on the ground, and subsequently to underplant with a species which tolerates, or benefits from, such sheltered conditions. There can be no doubt that the key to the economic treatment of this sort of wood lies in the utilization of the existing stems, poor though they may be. By selling or using them on the farm for bean sticks, stakes, gate posts, and firewood, it is usually possible to go a long way towards covering the cost of preparing the ground for planting. It is becoming increasingly common to sell the standing growth to a contractor, who should agree to leave the site in a good state for planting.

Once the site is ready, the work of planting is usually straightforward. Depending upon the species chosen and the site conditions, 1,200-2,000 plants per acre would be needed for full replanting over the whole site, but the number might be very much smaller if planting were necessary only in groups. The cost of well-grown trees ready to be put out into the forest is £6-8 a thousand, and the cost of planting should not exceed £2 10s. a thousand. A certain amount of drainage may be necessary, and it is usually advisable to put a rabbit-proof fence around the newly-planted area; even where there are no rabbits, a stock fence will often be necessary.

A. D. Miller

Future Pig Production Three types of pigs for commercial production are recommended by Sir Harold Howitt's committee in their report (Cmd. 9588) published on October 20. They are: a specialized pig for bacon curing, a specialized pig for lightweight pork production at 80-100 lb. dead weight, and a dual-purpose pig suitable for the medium and heavier weight of pork and for bacon. The latter, carried on to heavier weights without putting on too much fat, would also meet the present demand for heavy pigs for manufacturing. In the view of the Committee no real progress in the British pig industry will be possible until the efforts of breeders and producers are concentrated on a few clearly defined types of pig.

No Rabbits—No Guns Now that myxomatosis has swept over most of the country, some of the more unexpected results can be seen, such as a slump in the manufacture of sporting guns. Few people, including even experienced gun-makers, would have believed that the disappearance of the humble rabbit could have such a disastrous effect on the sale and repairs of guns. Orders for new guns are fewer than at any time since the end of the war, while repairs are but the merest fraction of what they would be in a normal shooting season.

Cartridge sales have also slumped heavily, men who previously bought in hundreds now being content with a box of twenty-five—and making this small number last for several weeks. It gives a good idea of the thousands of rounds that used to be fired at rabbits all the year round, year after year, when the amount of shooting this year is compared with the days before the disease got such a grip in the country. To those of us who gain our living from gun-making, rabbit shooting was almost our bread and butter trade, for it was both regular and widespread, bringing work into the trade when the seasonal orders were finished.

In Birmingham, which is the real home of English gun-making, most hard hit are the outworkers who are self-employed, working in a variety of small workshops dotted about what is called the gun quarter. These men rely on a constant flow of work from the smaller gun-makers who employ very little regular staff, getting most of their gun sections done around the trade. Now the orders are not forthcoming, and very little work is going into the work-

shops of the outworkers, with the result that more and more are seeking jobs in other trades.

It seems that a great pest has been removed, or at least largely reduced, to the benefit of all who cultivate the land. As good citizens we cannot complain of something which is so obviously to the common good, and we can only hope that new uses will be found for shotguns so that the old trade will not die out completely.

C. W. Fairley

The Rival World There has been a lot of discussion since the war about the steady increase in the human population of the world and the consequent problems that it is throwing up. The glare of publicity has not, however, fallen with anything like the same intensity upon the other, and numerically far superior, community of the Earth—the insects. Yet expansion in this sphere, if unrestricted, takes place at a rate which defies the imagination. And many of these insects are our deadly enemies, carrying disease and pestilence, destroying property and consuming a third of all we grow.

A new production of the Shell Petroleum Film Unit, *The Rival World*, which had its first public showing in London last month, stresses the vital character of the battle which has been joined between the two worlds. With its brilliant photography and first-class colour, the result is an enthralling and dramatic film that challenges any product of fiction. Small wonder it was awarded the first prize in the industrial documentary section at the Venice Film Festival. In a series of startling close-ups of insects working and eating, we are introduced to a world of infinite variety and fantastic shapes. First, the film shows the principal disease-carriers—the mosquito, tsetse fly, etc.—and the grim results of their activities, and then the attacks of insects upon the world's food—in the European orchard, African maize field, American wheatland, and Eastern tea garden. But it is in the tropical and sub-tropical countries that the depredations of insects are most clearly seen, and it was there that most of the film was shot. Thus, finally, to epitomize the battle against insect domination, the film-makers have chosen an awe-inspiring example from the tropics—the immense locust invasions of East Africa and the Sudan, filmed both from the ground and the air.

As the film points out, man can fight back only by marshalling his forces and by unremitting work to discover and improve control measures. Much is being done already by international bodies, but much remains. And it is a problem which affects everyone, no matter where they live, for insects—the greatest single danger to man's health and crops—know no political boundaries.

Copies of *The Rival World* will shortly be available in both 35 and 16 mm. for free loan to responsible bodies and clubs. Applications in England and Wales should be sent to The Petroleum Films Bureau, 29 New Bond Street, London, W.1. Overseas inquiries should be made at the Shell Company in the country concerned. Running time is 25 minutes.

New Chairman of B.B.C. Agricultural Committee Mr. Clyde Higgs has been invited by the B.B.C. to be Chairman of its Agricultural Committee in succession to Mr. W. S. Mansfield, whose resignation was announced recently. Mr. Higgs has already served two terms as a member of the Committee and, like Mr. Mansfield, was formerly a member of the Ministry of Agriculture's war-time Sub-Committee which advised on agricultural broadcasting.

Mr. Mansfield was appointed as Chairman of the B.B.C. Committee in 1945.

IN BRIEF

Hybridization

"Our increasing ability to use hybridization—the mating of parents of unlike ancestry—to 'supercharge' the cells of plants and animals to produce higher yields is one of mankind's most promising insurance policies against future world hunger," writes Henry Wallace, one-time Secretary of Agriculture and later Vice-President of the United States, in the October issue of *The Reader's Digest*.

Through the "genetic tricks" of hybridization, large domestic strawberries have been imbued with the flavour and fragrance of tiny wild ones. Seedless water melons have been produced. Hybrid onions yield three times as much as the old varieties.

Hybrid maize was the first great success story in this field. Planted on only a few thousand acres twenty-five years ago, it is grown today on 96 per cent of all acreage sown to maize in the Midwestern "Corn Belt", and results in about 500 million bushels of grain annually, with no increase in land or labour.

Not only with plants, but with animals and poultry, hybridization has yielded sensational results. A hybrid hen may lay three dozen more eggs a year than one average standard-bred. Though the hybridizing of animals is slow and expensive, research workers and stockmen are now making progress in growing pigs with leaner, tastier bacon, and dairy cows that will produce more milk.

"I confidently believe," Wallace concludes, "that through hybrid power most farm plants and animals, fifty years from now, will be of higher quality and far more productive."

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Bark Ringing of Apple Trees

Progress in breeding new varieties of tree fruits is limited because the seedlings do not normally begin to bear their first fruit for 5-10 years. Apple seedlings are especially slow in coming into bearing. Thus any means of reducing this period will be welcomed by fruit tree raisers.

At the Canadian Department of Agriculture Experimental Station, Summerland, British Columbia, experiments have been made to determine the extent to which the fruitless period (that is, the time between seed and first fruit) in apple seedlings may be shortened by bark ringing. Bark rings, approximately ¼ inch wide, were removed from the central leaders of trees at 3-5 feet from the ground. The wounds were allowed to dry for fifteen minutes and then covered with an emulsified asphalt tree seal. The ringing was done in the first week of June and its effect evaluated the following May by counting the blossom trusses on ringed and on unringed trees in adjacent rows. Most of the trees were in their eighth year from seed when treated.

Two years' experiments indicated that ringing could shorten the fruitless period by one or two years in trees that were close to the end of their juvenile phase. In very young seedlings, ringing had no effect on blossom formation. In trees ready to bear fruit, irrespective of forcing, ringing increased the amount of blossom per tree. Most of the blossoms, and on many trees all the blossoms, were formed above the ring. The ringing effect lasted for one year only, and trees which failed to respond to the first treatment had to be ringed again. Although the ringed trees suffered some shock, none was lost by the treatment.

Jungle Farming

The day of primitive agriculture in the jungle clearing is drawing to an end. The trees were felled and the crops were planted. Then after a few seasons the soil fertility began to fall, and by and by the jungle cultivator moved on, the forest moved in and the soil slowly recovered its fertility. But the impact of modern life is breaking down this traditional pattern of agriculture which has been followed for centuries in the tropical areas of the world.

Once tribal wars and disease laid jungle populations low, so the little patches of cultivation in the ocean of the trees were small and infrequent. But modern medicine and the suppression of inter-tribal wars are sending birth rates up and death rates down. So the jungle areas must support greater populations, and the people who live in the jungle are all trying to get more out of it than they once did. They are not producing only for themselves; they are producing also for sale in the towns and on world markets. The old leisurely cycle of cultivation and forest fallow is speeding up. The scars of cultivation in the jungle are hardly healed before they are ripped open again for fresh cultivation. And the people who are cultivating these patches in the jungle are hanging on to their land a little longer, trying to get a little bit more out of the flagging soil before they move on. Or coarse grasses are springing up, stock are coming in and the natural regeneration of the land by the forest is being stopped altogether.

Deterioration of the soil in the tropical forests has not yet reached a very serious stage. But, unless early action is taken to counter it, this spoliation will be serious within a very few years. This, among many other problems, the Food and Agriculture Organization of the United Nations is tackling.

Broilers

The consumption of broilers in this country was put at between 15 and 25 million birds a year by Dr. R. Coles at the B.O.C.M. Conference at Stratford-on-Avon. The American appetite for poultry meat, by comparison, is far ahead of ours—some 1,000 million broilers were produced in the U.S.A. last year.

From the 300 or so farmers and scientists who attended this conference it was clear that British broiler production is a flourishing and progressive industry. Mass production methods were described by Squadron Leader A. G. A. Fisher, one of the principal speakers, who has about 22,000 birds at Framfield, Sussex, at the moment and is planning to extend his housing to accommodate another 20,000. Major G. Bowley, at Whaley Bridge, Cheshire, on the other hand, favours comparatively small pens for his present 6,000 flock.

It is absolutely necessary, said Major Bowley, to sell your birds *before you start* a broiler project, find out the weight and specification required, arrange a date for the delivery of the finished product, and shun "weird and wonderful" equipment.

Rat Ravage

The world loss in agricultural production caused by rats and other rodents is estimated by F.A.O. at between £200 and £300 millions a year. To this must be added the unassessable losses arising from the forty or so types of

disease which they spread. In France, cereal crops alone are estimated to suffer to the extent of £4-5 millions a year. This summer, however, a co-operative campaign in that country has destroyed up to 400,000 rats.

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Guaranteed White Fishmeal

The white fishmeal manufacturers of Hull and Grimsby are pooling their resources to market a new, pure white fishmeal which will be the first in the world to carry a triple guarantee of quality. Protein percentage is guaranteed to be at least 66 per cent, oil content less than 4 per cent, and salt less than 2 per cent. A special priority scheme will be started to enable farmers mixing their own rations to get full regular supplies of the new meal.

The Hull factory is the biggest producer of white fishmeal in the world, with an annual output of 35-40,000 tons: the Grimsby plant is the second largest in Britain, producing 25-30,000 tons annually. Together the factories produce about 70 per cent of the white fishmeal manufactured in this country and, in doing this, use nearly a quarter of a million tons of fish and fish offal a year.

White fishmeal is one of the most valuable protein feeds available to the farmer; a meal of the quality now being marketed by the Hull and Grimsby factories will have a true feed value considerably greater than many of the other forms of animal protein feedingstuffs and also of the best vegetable protein concentrates. With its low oil content, there should be no danger of its tainting pig and poultry meat and eggs.

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Liquid Manure

At last I have found a sensible contraption to handle liquid manure—a messy job at any time. This is a 200-gallon tank mounted on wheels, to be drawn by a tractor. The cunning part is that the air is exhausted from the tank by an engine and pump; a pipe is put into the liquid manure tank, a valve opened and in no time the carrier is full. The liquid is sprayed as it pours on to a rotary vane. There is no doubt about the value of liquid manure; the difficulty is the distribution, and this seems to be the answer.

Clyde Higgs, The Countryman

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Swine Fever Vaccination

Crystal violet vaccine has removed one of the greatest risks in pig farming. There has been a suggestion that the vaccine induces sterility, but a recent field survey carried out by the Ministry among herds and various breeds scattered all over the country has shown it clearly to be without any foundation in truth. Crystal violet vaccination has no adverse effect whatsoever on fertility, or on the size or health of litters.

The cost of the vaccine has now been reduced to 4*s*. for a dose of 10 c.c. and 2*s*. for a dose of 5 c.c. to farmers whose pigs are registered under the Swine Fever Registered Vaccinated Herds Scheme.

BOOK REVIEWS

Scientific Horticulture. Vol. XI. 1952-54.

The reappearance of *Scientific Horticulture*, the Journal of the Horticultural Education Association, will be warmly welcomed, as also will the promise of annual publication in future. Conferences, demonstrations and lectures are liberally provided by the Association for its members, who are mainly engaged in advisory, teaching and research work, to keep them in touch with modern trends and developments in the science and practice of horticulture. To skim the cream from three years' output must have been an extremely difficult task, but the twenty-four articles included in this volume form a well-balanced selection.

Among contributions of general interest, one by Dr. E. W. Russell on the maintenance of soil productivity gives an account, masterly in its clarity of exposition, of soil structure and the interplay of cultivation and organic matter. This merits close study by all connected with soil problems.

The tradition for publishing surveys of regional horticulture is continued with articles on Kent, its industry and soils. Appropriately, these are followed by five papers about cherries. Some of the most valuable contributions, however, are background surveys concerning specialized productions—for example, the account by F. R. Horne on " Winter Cauliflowers in the South-West ". This illustration of the approach to particular local needs underlines the complex problems involved in work such as practical plant breeding.

The delay in disseminating results of research work is deplored in the foreword, and it is stated that future issues will aim at reducing this. No doubt the dangers of premature publication of incompleted work, and of recommendations not tried out in practice, will be borne in mind.

In this volume the horticulturist's need for knowledge of fundamental research and of research techniques is catered for by two papers on virus diseases, as well as by several on glasshouse work emanating from the Association's conference at John Innes Institution. Some of these contributions (apart from R. Cropley's excellent thesis on the selection of virus-free fruit plants) unfortunately suffer a little from too meagre lists of bibliographical references, and, occasionally, from the point made in the foreword—delayed publication.

This journal is of real value to the serious horticulturist for reference, no less for the articles than for the glossary of pruning terms compiled by the Association's Fruit Committee. This should form a long-term standard for future horticultural teaching and writing. All the contributions are authoritative without being abstruse, and readable while avoiding the inaccuracies inherent in " popular " writing.

Scientific Horticulture is issued free to members of the Association. Non-members may obtain copies from Gibb and Sons, 16 Orange Street, Canterbury, Kent. It is priced at 17*s.* 6*d.* (including postage). *K.H.J.*

Diseases of Fruits and Hops. (3rd edition). H. WORMALD. Crosby Lockwood. 25*s.*

To most fruit-growers, plant pathologists and advisory officers Dr. Wormald's work is already so well known and well-thumbed that little need be said about this third edition beyond the fact that the text has been revised and brought up-to-date throughout. This has meant in particular the virtual rewriting of the chapter on fungicides, and the addition of much new information gained from recent British research into the virus diseases of our fruit trees and bushes.

Those still unacquainted with the book will find it an invaluable aid in identifying the various fungus, bacterial, virus and functional diseases that attack and cause loss among fruit trees cultivated in our orchards and gardens. The arrangement is an unusual one, but it has stood the test of time, for the first edition appeared sixteen years ago. Under each host the diseases are grouped according to the parts of the plants they attack—roots, stems and branches, leaves, flowers and fruit. This inevitably leads to repetition and cross-reference for those diseases that attack more than one organ or have more than one host, but the subject is treated discreetly and without confusion. It is, in fact, relatively easy for the reader, whether grower or scientist, to identify a disease from the symptoms described, even if only one of the several organs that might be attacked is available.

Each disease is dealt with clearly and concisely, with particular emphasis on symptoms, varietal susceptibility, and control; and many of them are beautifully illustrated in the 160 or so half-tone photographs that make up the 48 plates. There is also a new frontispiece in colour showing strawberry virus diseases. References are added to the description of the disease for those who want to consult the original British research papers. *W.C.M.*

Shooting (Shot Gun) (" Know the Game " Series). Educational Productions Ltd. 2*s*.

This little publication is a " must " for the beginner with a gun. There are even a few veterans who might benefit from such a conveniently potted refresher course as this. Most valuable of its lessons is the section on Safety in the Field, particularly those simple rules which are rightly described as fundamental. Probably the " fool with a gun " will always be with us, but the man of average intelligence, having learned these rules and come to practise them religiously, will at least be a safe companion in the field. They cannot be too strongly stressed nor too often repeated.

In a booklet of this kind it is obviously not possible to include everything relevant to the sport of shooting; but some will wish that the section on The Dog could have been extended to cover the very important matter of gun-shyness. Given a normal, healthy pup in training, in half an hour it is possible to determine, for good or ill, his future as a gun dog. It is easy to make him gun-shy and useless for life; just as easy, with a little care and patience, to ensure that to him the report of a gun is an accepted incident of his working day.

Although I am among those who believe that correct " lead " cannot really be taught (so much depending on individual quickness, judgment and body movement), the sections on forward allowance are a valuable basis on which the beginner can experiment and, in due time, reach a solution compatible with his own particular physical requirements.

The illustrations, in the main, are both good and useful: but are the publishers entirely satisfied with the stance of the shooter depicted on the front cover?

However, this is as good a two shillings' worth as any shooter could desire. It would not be a bad thing if the authorities, before issuing a gun licence to a tyro, required him to satisfy them in an examination based on certain of its precepts.

F.H.L.

Applied Entomology (5th Edition). H. T. FERNALD and H. H. SHEPARD. McGraw-Hill. 52*s*. 6*d*.

The late Dr. Fernald was the author of the first three editions of this book and the co-author of the fourth edition, which appeared in 1942. The present (fifth) edition has been substantially rewritten by Dr. Shepard, though still retaining the original format. The revision has been necessitated by the rapid developments in the formulation of insecticides and the methods of their application in recent years, and even by changes in the economic importance of pests—the latter not entirely unconnected with the use of insecticides.

The chapter on organic insecticides bears testimony to this progress: DDT, BHC (gamma-BHC), methoxychlor, aldrin, dieldrin, the phosphorus insecticides and many others have all appeared since the publication of the fourth edition. By way of contrast, it is comforting to the practising entomologist to note that insect morphology and taxonomy have remained substantially the same in the last thirteen years, even on the other side of the Atlantic. The introduction of footnote guides to pronunciation will rescue many a student from embarrassment.

The revised edition will undoubtedly prove a boon to American entomologists at all levels. For European entomologists, concerned with a different pest complex, it will be a useful work of reference.

D.P.J.

Thirty Acres and a Cow. DAVID ENSOR. Hale. 15*s*.

To give up a brilliant legal career at the age of 41 and to turn to farming without previous experience and with no great capital, demands courage of a high order. To make a success of it and to establish a thriving farm of one's own in a mere half-a-dozen years connotes extreme ability and enterprise. But that is precisely what Mr. David Ensor has done. Exactly how he and his wife buckled to and overcame the rigours and problems of their new life is told in this stimulating and, in many ways, inspiring book.

The first thirty pages or so of the book are devoted to an account of the author's rapid rise to a position of eminence in the legal world and of his war service. Here is a self-portrait of a successful and socially well-connected lawyer. Ambitious, meticulous, severely critical of the mediocre, a keen seeker after experience—these were qualities which were obviously to stand him in good stead when he took to farming. The remainder of the book furnishes the real meat: his seeking for a job, the first milking, a startling advance in two years from raw novice to head cowman of a famous pedigree herd, and, eventually, a small (Dorset) farm of his own.

The book is pleasantly written, but the frequent diversionary comments on all kinds of rural topics draw away from the interest of the personal narrative. Clearly, Mr. Ensor does not suffer fools gladly, but one doubts the need for some of the uncompromising views which he expresses. Some surprise will also be evinced that the author sees no need to take his labour costs into account when calculating profits.

These and some other points, such as a plethora of footnotes in the early part of the book, detract from an otherwise well-produced publication. But, in spite of these blemishes, it is impossible to remain unimpressed with the deep content and satisfaction of the author in his chosen work and at the sterling way in which he and his wife faced up to self-denial and hard work to achieve their objective. It is a book which anyone looking for a worthwhile and individual life, or an inspiration to further effort, should certainly read.

L.W.T.

An Economic Study of Pig Production in South West England, 1953-54. ESTELLE BURNSIDE and W. M. STRONG. Department of Economics, University of Bristol. 2*s.* 6*d.*

The investigation which forms the basis for this report was carried out on 56 farms in Devon, Dorset and Cornwall during twelve months from October 1953 to September 1954. The general analysis of costs tables shows that food accounts for 87 per cent of the total costs, adding further support to the already established fact that it is by far the most important item. Home-grown corn amounted to only 8.3 per cent of total food costs, emphasizing once again that the pig on the farm has a "factory bias". It is unfortunate that it was not found possible to establish the conversion rate of meal fed per pound liveweight gain, because this is the figure that really matters as a pointer both to breeding and management.

The litter averages of 47 herds are given as 9.5 born alive and 8.1 weaned, supporting the accepted view that mortality in the pre-weaning period is too high and must be reduced. There is the usual clue to the causes of loss, in that 65 per cent of the deaths were due to the piglets being "laid on".

In its assessment of profitable systems of production, the report shows that selling stores and weaners, or breeding and fattening, yield more profit than purchasing and fattening. This is as it should be, for where conditions are suitable the advantages of both breeding and fattening on the same farm will be obvious.

In all, this is a most useful report which will prove of interest and profit to those who breed or feed pigs.

W.T.P.

National Institute for Research in Dairying Report, 1954. 4*s.*

The latest report of the N.I.R.D. begins with a useful introductory note commenting briefly on the work of the Institute in general, with particular reference to points which are most likely to interest the practical dairy farmer. Thus milking investigations reported include those on rate of milk secretion, the effect of teat-cup liner tension on milking rate, and measurements of rate of machine milking in relation to lactation yield.

In grassland agronomy trials with three different grasses grown in association with white clover, meadow fescue consistently outyielded both perennial ryegrass and cocksfoot when compared in terms of milk output. Other dairy fodder trials involved a comparison of pick-up baling of hay from the swath with tripoding followed by baling; the nitrogenous manuring of grass for silage; and the use of sodium metabisulphite or esters of halogenated acetic acid in the preparation of silage. Chopped or lacerated herbage produced better silage than material not so treated.

Work on the keeping quality of milk included a test of menadione. It appeared to have no value in preventing souring when added to raw milk or to the food of milking cows. Studies on various aspects of the mastitis problem are described.

In the section dealing with pig research an account is given of the successful elimination from the Shinfield herd of virus pneumonia—an infection which has interfered with the accuracy of pig experiments in the past. Reference is made to the growth-promoting effect on pigs of copper sulphate, and to trials with sow's milk substitutes.

Some interesting reports on tests made on commercial dairy equipment are also recorded.

Copies of the report may be obtained from the National Institute for Research in Dairying, University of Reading, Shinfield, nr. Reading, Berks.

A.J.L.L.

The Calf: Its Management, Feeding and Health. J. H. B. Roy. Farmer and Stock-Breeder. 5*s*.

It is hardly possible to exaggerate the necessity for giving the young animal a good start in life, because its performance when adult may largely be determined by the treatment it receives in its first few months. Nevertheless, care of the calf is often the weakest link in the chain of the cattleman's craft and, for this reason, the appearance of this excellent little book will be welcomed by many.

Management and feeding are dealt with in the first sixty pages. The birth process is briefly described and the importance of colostrum for the newly-born calf is rightly emphasized. A good deal of attention has been given to ways of economizing in the use of whole milk without loss of efficiency, and this aspect may well be the most valuable in the eyes of the dairy farmer.

This part of the book is well supplied with tables giving many alternative rations for balancing skim milk and whey, and for the construction of " follow-on " mixtures and calf-starters. The rations are first class in the choice and suggested proportions of ingredients, but some of the figures for starch equivalent and other values given at the foot of the tables contain obvious errors. In the rations where ground linseed is an ingredient the starch equivalent and digestible oil are seriously underestimated, and although this does not invalidate the rations themselves, the farmer might well be dissuaded from using these by starch equivalents apparently 10, or even 20, units less than they ought to be. This, however, is a minor defect which must not be allowed to detract from the usefulness of a most informative section. The thoroughness of the work is shown by the fact that one table contains details of no less than eleven alternative methods of feeding!

Good advice is offered on the use of roughages and emphasis is laid on quality. It is true that really good hay can be a useful source of vitamins, but since the farmer's assessment is often too optimistic, it is perhaps safer to include a synthetic source of these in the concentrate ration. This is particularly so for vitamin D which, by the nature of things, tends to be less where carotene (the forerunner of vitamin A) and vitamin E are greater; in any case, green foods (dry or succulent) are usually able to take care of the two latter.

Other points in management which are well covered include housing, castration, dehorning and marking.

The last twenty pages of the book are concerned with diseases—both those which may be acquired from the dam and those picked up from infected premises and pastures. There is much useful practical guidance given for the prevention of infection.

The book contains many clear illustrations and diagrams which enable instructions to be followed easily. The matter is well laid out and only one printer's error has been noticed. But since this may puzzle or even mislead the reader, it is perhaps necessary to comment upon it: in the discussion on copper deficiency on p. 43 occurs the phrase " the hair and the eyes become grey . . . ": no doubt this should read " the hair around the eyes becomes grey . . . "

S.M.B.

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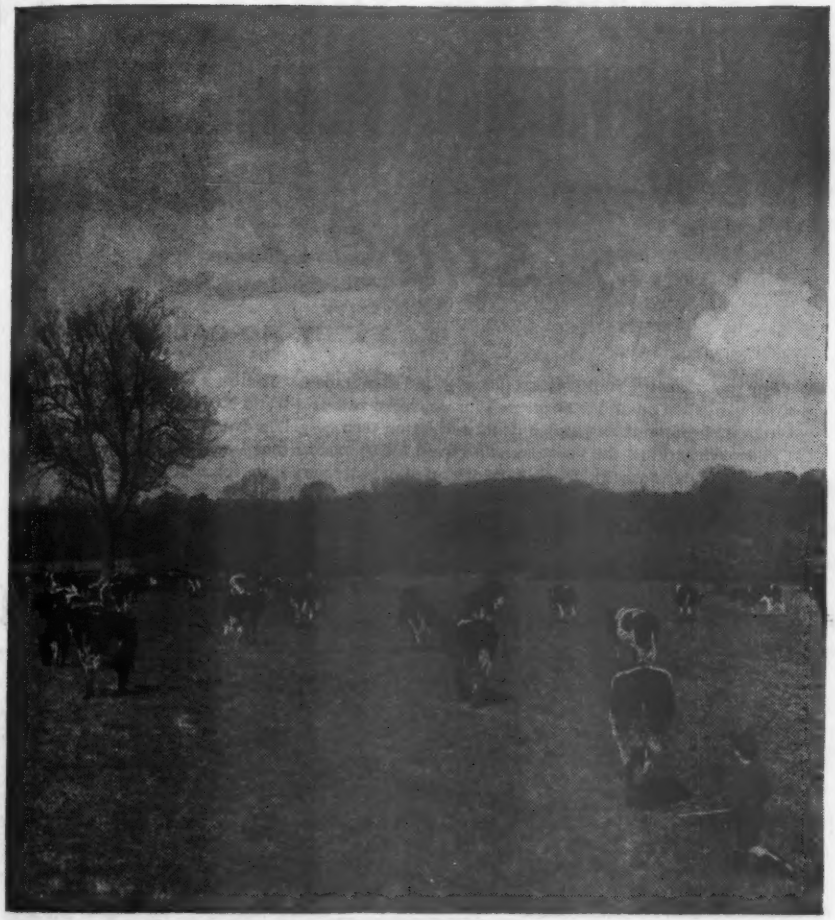

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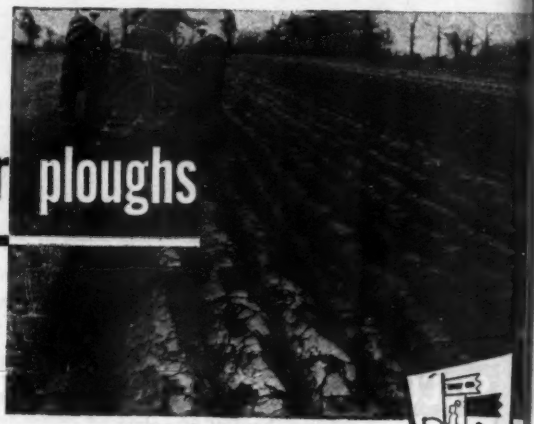

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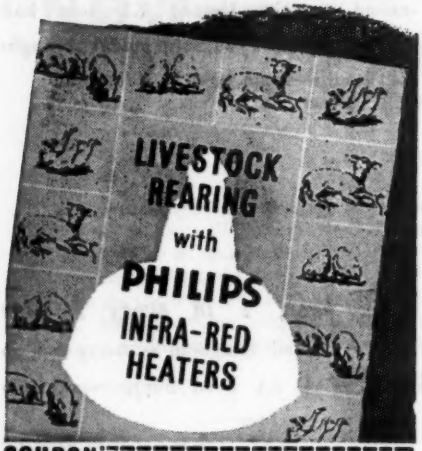

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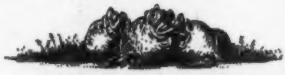

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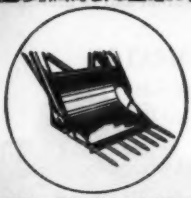

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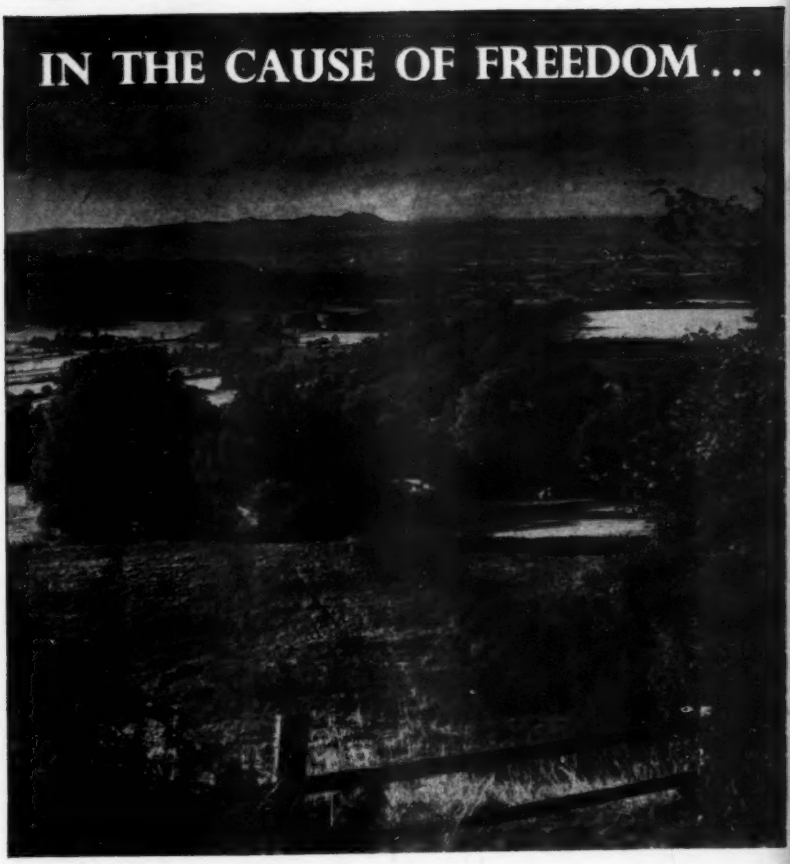

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The Food and Agriculture Organization of the United Nations was established in 1945 to help the member countries in this task. On the 16th October, F.A.O. celebrated its 10th anniversary, and I.C.I. is proud to pay tribute to this organization for the great work it has accomplished during these years. I.C.I. itself, with extensive research facilities and a vast output of products for increasing food production, is giving powerful support to the progress of agriculture in many lands.

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